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PUBLIC WORKS.

CITY COUNTY STATE

A Combination of "MUNICIPAL JOURNAL" and "CONTRACTING"

Vol. 54 June, 1923 No. 6

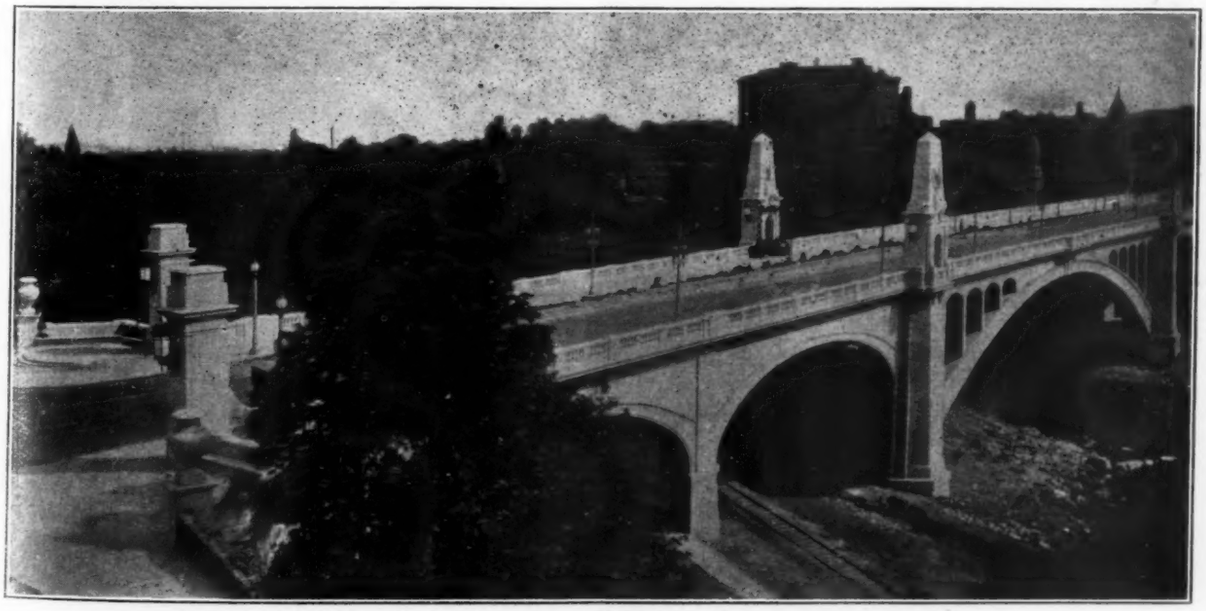
Wilmington's Memorial Bridge

A reinforced concrete structure, notable for rational design, exceptional arch proportions, strength, capacity and harmonious decorative features.

By Frank W. Skinner, M. Am. Soc. C.E.

On Decoration Day, May, 30, 1922, impressive ceremonies marked the formal dedication to the Delaware soldiers and sailors of the Nation's wars, especially the World War, of a bridge across Brandywine creek in the city of Wilmington, Delaware. The bridge is not only a memorial structure but is of great practical service, carrying important vehicular traffic of the Washington Boulevard. It demonstrates that grace, strength and durability are obtainable by concrete arch design at a cost less than the ultimate expense for the building and maintenance of an alternative, minimum cost, all steel structure that is solely utilitarian.

On March 31, 1919, the Governor of Delaware approved an Act of the General Assembly authorizing New Castle county to issue bonds for the construction of a new bridge across the Brandywine at Washington street and naming a commission to carry out the purpose of the Act. The commission with Alfred I. DuPont as chairman, was organized shortly afterward and appointed Frederick W. Carpenter of New York to act as executive officer and consulting engineer of the commission, and promptly invited several reputable bridge engineers to submit competitive designs for the bridge. Each competitor was furnished with a set of plans of the existing old steel structure together with a profile of the site and the proposed length and width (60 feet to 63 feet) of the new bridge and was asked to submit with his design an estimate of the cost of same. It was provided that each competitor would receive $500 as payment in full



VIEW OF WASHINGTON MEMORIAL BRIDGE FROM BRANDYWINE PARK.
Showing the general proportions of the structure, together with the architectural treatment of the north portal and the main pylons, upon the faces of which the memorial tablets of bronze are mounted.

for his services in the event that his design was not accepted by the commission, and that the commission would enter into a formal engineering contract with the competitor submitting the accepted design.

On August 14th, out of ten designs submitted, that by Benjamin H. Davis, of New York City, in the preparation of which Vance W. Torbert, architect, had collaborated, was selected by the commission.

The approved design was selected entirely on its merits, the estimated cost—$594,769 for a bridge 63 feet wide—was the highest submitted by any of the engineers competing.

On August 23, the commission entered into a memorandum of agreement with Davis and Torbert, at the customary engineering and architectural fees, providing for the preparation of all necessary plans and drawings, form of contract, bond and proposal, and for complete supervision during the construction of the bridge.

About the end of November the commission ordered plans prepared for a bridge 82 feet wide instead of 63 feet wide and bids for this wider structure that were received on January 26, 1920 from four contractors varied from a minimum of $800,816.30 for all concrete to $1,753,279.80 for concrete with granite facing.

The design was then revised to provide a bridge 72 feet wide and the lowest bid submitted by the contractor who eventually received the award was $747,743.15. The extra cost of precast stone work subsequently ordered by the commission brought the cost of the completed bridge to a total of $751,980.91 exclusive of engineering and the administrative expenses of the commission.

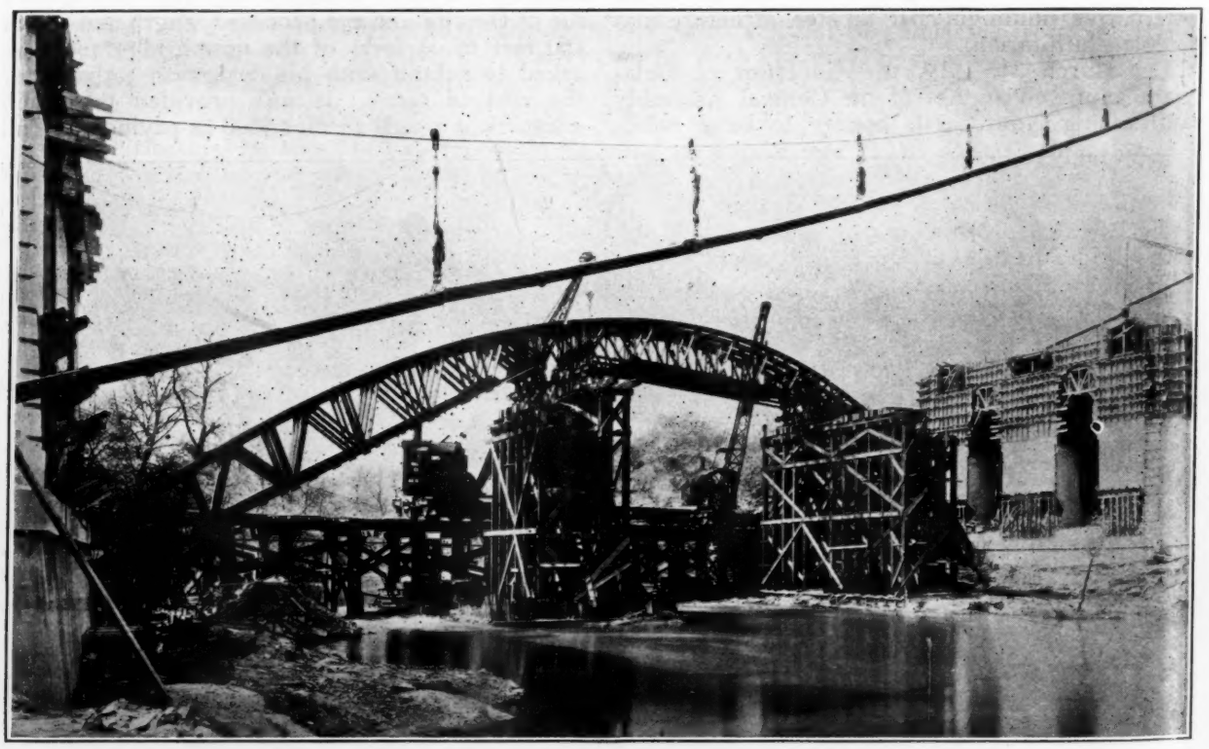
THE BRIDGE DESIGN

The bridge, which is built on a skew of 30 degrees, is 734 feet long and 72 feet wide over all, with a center height of 65 feet from the high water level of the creek to the top of roadway. It has two 16-foot sidewalks proportioned for a live load of 100 pounds per square foot and a 40-foot roadway with two trolley tracks, each designed to carry trains of 60-ton electric cars, 60 feet long. Two full lines of 20-ton motor trucks with 12-foot wheel bases were also assumed as part of the live load, for which an impact allowance was made according to the formula:

$$\text{Impact} = \frac{\text{Live Load}^2}{\text{Live Load} + \text{Dead Load}}$$

The arch rib strains were computed by Cain's elastic theory and the arch rings were propotioned for total combined stress—dead load, live load, ring shortening and temperature—not exceeding 750 pounds per square inch in the arch ring masonry. The reinforced concrete floor slabs and beams of the structure were also proportioned for maximum stresses of 750 pounds compression per square inch in the concrete and 16,000 pounds per square inch tension in the reinforcing steel.

Very careful study was made to develop a design for the bridge in harmony with the natural features of the site, including canals, railroad and park driveways, in order to make the bridge an impressive and beautiful feature of the landscape.



STEEL CENTERING IN PLACE FOR FIRST RIB OF 250-FOOT SPAN.
Showing the three-span steel centering before the lagging and side forms had been erected, and also the wooden falsework towers supporting the centering from bed rock in the stream bed.

A structure having five arch spans symmetrically balanced with respect to the creek was selected from numerous concepts as combining in the highest degree the structural, artistic, architectural and engineering advantages and possibilities of the bridge site, and the monumental and memorial features of the bridge were developed from the large central span as a primary motif. The massive center piers are surmounted by ornamental pylons 40 feet high, and smaller pylons command the bridge portals. Refuge bays are provided on both sides of the bridge at the center of the main span, and at the end of the structure, and the handsome balustrade of Onondaga Litholite is embellished with large ornamental urns at the extremities of the refuge bay at the north end of the bridge. A graceful stairway leads from the south end of the bridge to the park sidewalk below.

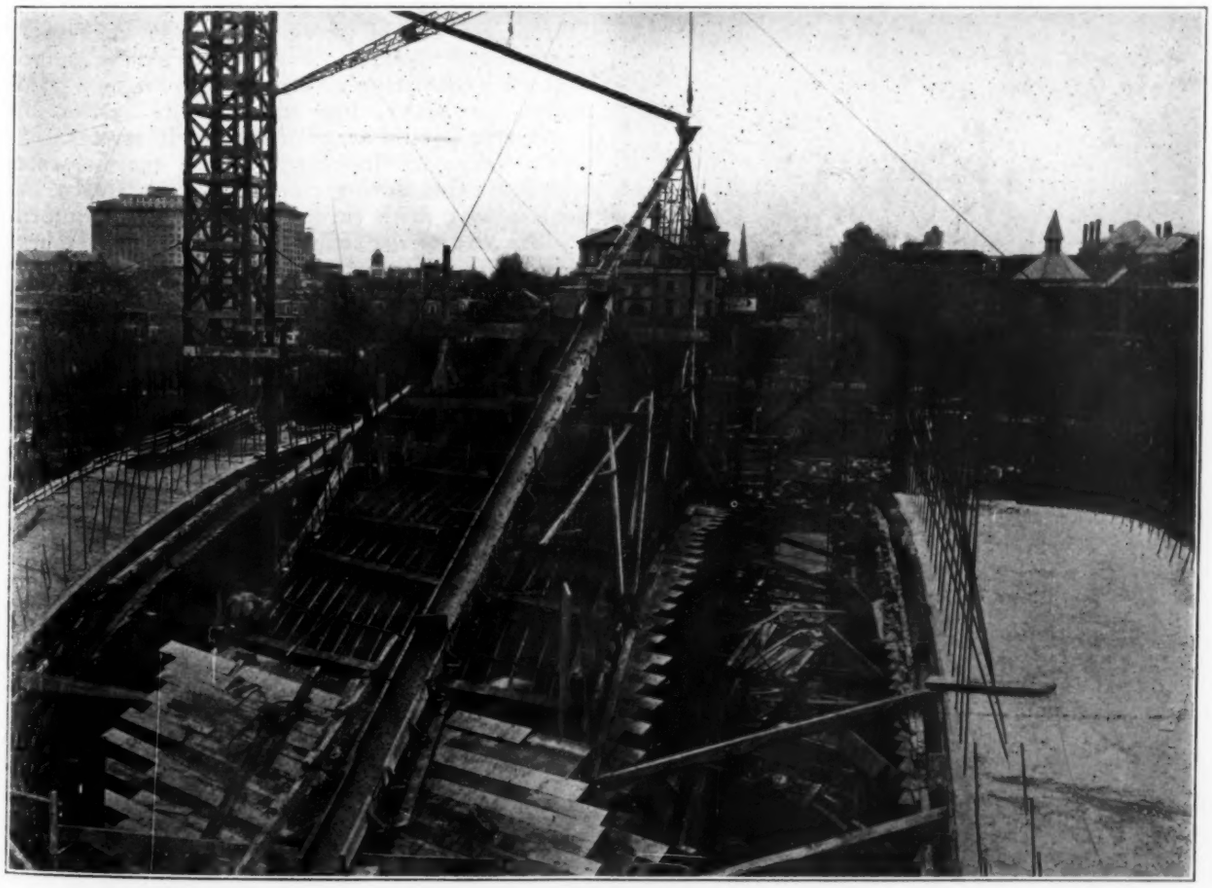
The bridge is lighted by twelve 250-candle-power incandescent lights in bronze bracket lanterns on the pylons and by twenty-eight 600-candle-power arc lights on ornamental metal posts set on the curb lines.

While the character and design of the entire bridge is of a decided memorial nature, the distinctive memorial features are embodied in four large bronze tablets placed on four monumental pylons or shafts, each tablet being 9 feet high by 5 feet wide. The first two of the large tablets commemorate all of the wars of the nation, and the last two tablets commemorate the World War, one having the names of the great battles in which Delaware troops fought and the other bearing the names of all those service men from the entire State of Delaware who made the supreme sacrifice.

Two channel piers, each 20 feet wide, shore piers 8 and 9 feet wide respectively, and two abutments support the 250-foot center span with 40-foot rise, two 70-foot spans with 15-foot rise, and two 85-foot spans with 18-foot rise. Each arch has a center rib 16 feet wide and two outer ribs 5 feet apart on centers, that are each 11 feet wide.

The center rib of the 250-foot span is 6 feet deep at the crown and 11 feet at the springing line and the outer ribs are 5 feet and 10 feet deep, at the crown and springing lines, respectively.

Over each of these arch ribs and immediately under the floor slab there is a continuous gallery, one of which is reserved for high tension electrical conduits, the second for low tension electrical conduits and the third for gas and water mains. The reinforced concrete floor slab, varying from 12 to 20 inches in thickness, exclusive of floor beams (which occur only at the expansion joints), is supported on longitudinal walls. These longitudinal bearing walls rest directly on the extradoses of the shore spans and are supported by the spandrel columns of the channel



POURING THE MIDDLE RIB OF AN APPROACH SPAN.
Showing one tower and counterweighted swinging boom of the spouting system employed in placing concrete.

span. The floor slab is arched transversely between ribs, and is cambered 12 inches to a parabolic curve longitudinally.

The foundations of all piers and abutments were carried down to solid rock at a maximum depth of 5 feet below water level.

CONSTRUCTION

Plant and materials were delivered to both sides of the creek over two sidings from the Brandywine branch of the Philadelphia, Baltimore and Washington Railway, which passes under the bridge. The contractors installed a service track on a temporary trestle crossing the creek, parallel and adjacent to the bridge. The concrete plant was established on the north side of the creek, where aggregate and cement were stored and a concrete mixer installed that delivered to the hoisting bucket of a wooden tower 210 feet high equipped with a steel chute supported by the tower boom and a counterweighted cantilever truss. From this wooden tower, concrete was spouted to the adjacent spans of the bridge and to the foot of an auxiliary steel tower 160 feet high on the opposite side of the creek, where it was re-hoisted and spouted to the other portions of the structure, a system of distribution that was well adapted to the conditions and proved sufficient and satisfactory.

VIEW BETWEEN RIBS OF THE 250-FOOT ARCH SPAN.

Showing the beamless floor slab construction and the expansion joints in the roadway slabs, giving a fair idea of the general appearance of the structure from below.

The best monthly record of concreting was 2,245 yards and the maximum output of the mixer was 282 yards in one working day. The total amount of concrete placed was 17,278 yards, of which 8,545 yards at $34 per yard was used for the arch rings and floor slabs, 2,443 yards at $25.50 for the spandrel walls, and 5,804 yards at $20 for the substructure, besides 485 yards at $35 for the pylons. The concrete was reinforced by 972,800 pounds of corrugated bars at 7 cents per pound in place.

All of the forms were built of wood, of simple standard construction and, with the exception of some of the floor slab forms, were used only once. The materials used in the arch centering, however, were used again and again in building centers and forms for subsequent spans. The pier forms were constructed in large panels for the full height of each pier from footing to under coping lines and the pier concrete was poured continuously and as rapidly as convenient at a maximum rate of about 23 feet vertically per day.

The piers were made in separate sections for each rib, the sections being independent for the short spans, but connected by curtain walls to give a more massive, monolithic appearance for the channel piers. The arch ribs for each of the 70-foot and 85-foot shore spans were successively concreted in wooden forms supported by timber centering consisting of vertical and inclined posts seated on heavy, longitudinal sills carried by transverse double bents of framed falsework.

The large 250-foot arch of the channel span was supported during construction on steel truss centers built with curved top chords to conform to the curve of the soffits of the arch rings. These steel centers were supported on two wooden towers erected in the bed of the creek, and on blocking at the springing lines. The wooden falsework towers consisted of two pairs of bents thoroughly braced together that were wide enough, parallel to the axis of the creek to reach from side to side of the bridge. The centers were made of a width sufficient to serve for the construction of one rib and were then lowered slightly and moved laterally into correct position to serve again and again for each of the other two ribs. These centers were erected by a locomotive crane operating from a service track parallel to the bridge. A wooden nailing strip of variable thickness was bolted to the curved top chords of the steel centers to provide suitable bearing and support for the 4-inch yellow pine, tongue-and-groove lagging used to form the arch soffits.

The main arch ribs were poured in alternate blocks and keys, each completed in one continuous operation. Each rib contained nine blocks 25 to 27 feet long, the intermediate keys having an approximately uniform length of 4 feet. When the arch ribs were at least 28 days old, the centers were struck by slacking the wedges under the bearings of the falsework trusses, and the

maximum deflection noted was ¼ inch for the short spans and ⅝ inch for the long span.

After the spandrel walls and upper portions of the piers had been concreted, the floor slab forms were set and concreted for the successive spans, each section between expansion joints being concreted in a single operation to make a continuous, monolithic slab.

The deck of the bridge and the backs of all retaining walls and abutments were waterproofed with a membrane consisting of two-ply cotton fabric saturated with asphalt, protected by a thin layer of concrete. All expansion joints were flashed with copper and caulked with oakum and asphaltic expansion joint cement.

STAIRWAY AT SOUTH END OF BRIDGE.
Showing granite composite balustrades connecting the sidewalks of the bridge with that of the park driveway below.

The exposed surfaces of the arch ribs, piers, abutments and spandrel walls were carborundum rubbed at a cost of 10c per square foot, and the pylons and balustrades were bush hammered at 15c per square foot.

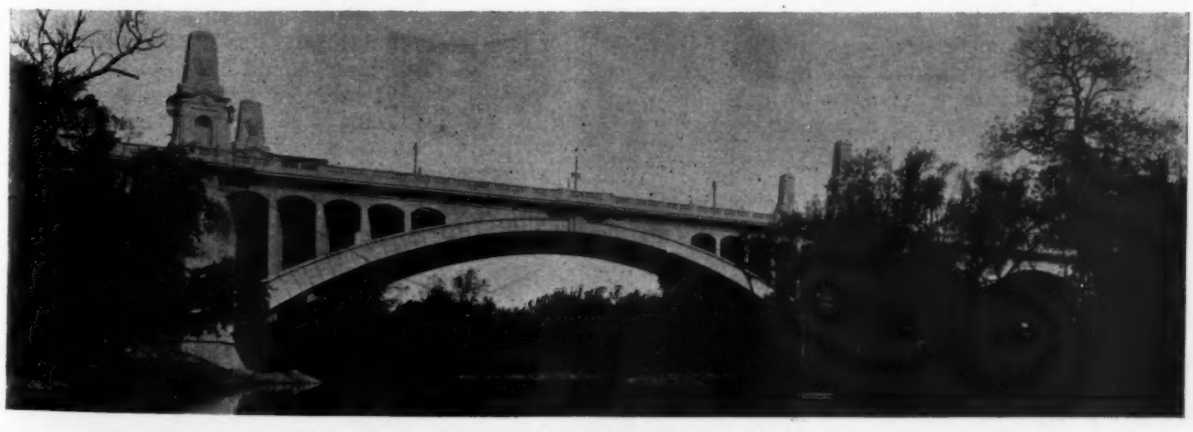
The Onondaga Litholite balustrades, shields, urns, eagles and pylon caps cost $36,775, and the bronze lighting fixtures, memorial tablets, name plates and ornamental lamp posts cost $19,880.

All of the concrete was made with Lehigh portland cement, of which 27,104 barrels were used; Delaware river washed sand, of which 10,537 tons were used, and Brandywine crushed granite of which 21,074 tons were used in the construction of the bridge.

The bridge was built by an average daily working force of 50 men and a maximum force of 85 men, working under the direction of H. K. Wilson, resident engineer for B. H. Davis. David Small, eastern manager, and E. C. Heber, superintendent, were in charge of the construction operations for the general contractors, the Walsh Construction Company of Davenport, Iowa.

Cost of Paving in Charleston

Charleston, South Carolina, laid 19,736 square yards of sheet asphalt last year at the following unit prices: Grading 5c. per square yard, 4-inch concrete base 89c., 5-inch concrete base $1.08, 6-inch concrete base $1.22, 1½-inch binder 45c., and 1½-inch top 44c. Four thousand six hundred and four square yards of creosoted wood block was laid along rails for $2.63 per square yard, the blocks being 3 inches deep and having received 16 lbs. treatment. These prices do not include tearing up and hauling away old granite blocks, vitrified brick and cobblestones from the old pavement, nor hauling in material necessary for bringing up the grade, but these were done as special items in the bid.



VIEW OF THE COMPLETED MAIN ARCH.

Treatment of Laundry Wastes

Condensed abstract of report on an investigation by Pennsylvania Department of Health.

By F. E. Daniels*

In order to obtain data upon which to base advice and approval of plans for treatment of laundry waste in places not provided with sewerage systems, the Engineering Division of the Pennsylvania Department of Health conducted a series of laboratory tests and field observations on wastes from steam laundries in Harrisburg and at one of the state sanatoria.

LABORATORY WORK

Sulphuric acid was used to bring the hydrogen ion concentration near the iso-electric point in order to facilitate precipitation. This was found to be exceedingly effective; for, when by the addition of sulphuric acid the solution was brought to the proper pH on the acid side of neutrality and then the solution made slightly alkaline with lime, an immediate coagulation and precipitation of the suspended and colloidal matters occurred, and a perfectly clear and sparkling supernatant liquor was instantly obtained. When such a mixture was placed on a filter paper the filtrate ran through as rapidly as clear water.

The Mont Alto Experiments.—The steam laundry at the Mont Alto Sanatorium is well equipped with modern machinery and the wash of approximately one thousand people is handled by it. Two toilets in the building discharge into the sewer so that in all respects the daily waste from the plant closely resembles that from any modern steam laundry. In passing it may be said that the presence of a moderate amount of toilet sewage seemed to have no effect upon clarification although a large percentage would no doubt demand some form of biologic treatment subsequent to the chemical precipitation.

The treatment plant consisted of barrels holding 50 gallons each, arranged in tiers, so that the discharge from the upper tier flowed into the lower and from the lower into half-barrels filled with sand to act as sand filters. Two sets or units were provided, one for the acid-lime method and one for parallel runs with iron sulphate and lime for comparison. In the upper tier two extra barrels served as reservoirs for milk of lime and iron sulphate solution respectively. Nipples of half inch pipe with stop-cocks and short pieces of rubber hose afforded convenient means for dosing and regulating flows.

The method of operation was as follows: The upper barrel of each unit was pumped full of laundry waste.

One hundred cc. of the waste was put into a glass tumbler and a small quantity of thymol blue indicator solution added. Then dilute sulphuric acid (1:5) was added drop by drop until the indicator changed to a faint orange color. This increased the hydrogen ion concentration, or, as we say, lowered the pH to about 2.6.

By means of a table, previously prepared, the amount of dilute acid required for 100 cc. showed the number of cc. of concentrated acid needed for the barrel, which, when measured out, were put into the barrel and its contents stirred.

The reaction being so rapid enabled the process to proceed immediately, allowing the acidulated waste to be discharged into a small much baffled mixing trough resting on the top of the lower barrel. At the same time a small stream of milk of lime was allowed to enter the trough and mix with the acidulated waste, the amount of lime being so regulated that the discharge from the trough showed only a faint pink with phenolphthalein indicator.

The discharge from the mixing trough dropped into a piece of 4" pipe suspended vertically in and reaching nearly to the bottom of the so-called lower barrel which acted as a settling tank. The coagulation and precipitation being so rapid and complete, the upward current was not sufficient to bring up suspended matters and the discharge from the top or overflow of the settling barrel was always perfectly clear, rendering the use of the half-barrel sand filter unnecessary for clarification.

Rates of flow up to the capacity of the nipples and stop-cocks were used which approximated less than 15 min. detention periods for settling.

For comparison 100 cc. of waste from the other unit were taken and tried with iron sulphate solution. From the amount required for 100 cc. the amount for the barrel was calculated and added. The mixture was then run into its settling barrel along with sufficient milk of lime to give a faint pink with phenolphathalein. The settling required about four times the period of detention as the acid-lime method, was not so easily controlled, and when the effluent was run upon the sand filter there was a tendency for it to clog and cake. The sand filter effluent, however, appeared perfectly satisfactory.

On account of cool weather the effects of the effluents in streams in mid-summer could not be definitely ascertained; but samples inoculated with sewage and kept at room temperature for seven days did not develop odor or show signs of decomposition. The effluents from the experiments were allowed to run to a nearby ditch and accumulate for a month. They showed no objectionable conditions whatever.

There was, however, in the samples analyzed quite a biochemical oxygen demand and it is possible that bacterial action was inhibited by the excess lime. For that reason unless biological filters are used, the discharge into streams should be in such a manner as to ensure quick dispersion into the diluting water, otherwise the discharge might give rise to organic growths such as are to be observed in streams receiving lime precipitated sewage.

Acid-Alum Method. — Sulphuric acid was added to the laundry waste to lower the pH from about 12.0 to about 7.0 using brom-thymol-blue indicator. Having determined by experiment the minimum satisfactory amount of alum to cause clarification, the proportionate amount for the quantity of water treated was added.

This addition caused a heavy precipitate which settled in 5 minutes to nine per cent. of the total volume, and in 12 hours to five per cent. of the total volume.

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The filtrate was clear, the colloidal suspensions having been removed, the total solids reduced about 70 per cent., the volatile matter lowered about 80 per cent., and the fixed residue reduced about 66 per cent.

The addition of alum further reduced the pH from 7.0 to about 6.0, but upon escapement of the CO_2 formed by the reaction the pH gradually rose to 7.0 or a little over. It is therefore desirable to remove the precipitate before the solution becomes sufficiently alkaline to redissolve any of the aluminum hydrate.

Cost of Treatment.—On the composite waste used it was found that 2.1 pounds of sulphuric acid @ 1.8 cents per pound and 2.8 pounds of alum @ 1.25 cents per pound were required for 1000 gallons, thus making a total cost for chemicals of 7.3 cents per 1,000 gallons.

SUMMARY

The principles of the clarification of laundry wastes are:

1. Correct alkalinity and adjust with acid to pH 2.6 for lime or pH 7.0 for alum.
2. Precipitate with lime or alum.
3. Settle; run off clear supernatant liquor.
4. Draw off sludge and dry on sludge bed.
5. Iron sulphate and lime may be used in place of acid and lime.
6. Comparative costs of clarifying chemicals per 1,000 gallons of waste are: acid lime method, 28 cts; iron lime method, 24 cts, and acid-alum method, 7.3 cts.

CONCLUSIONS

From the foregoing the following conclusions may be drawn:

1. The laundry wastes for the day should be mixed and the flow equalized so that treatment can proceed at a uniform strength and rate.
2. Sulphuric acid may be added to the waste as it enters the equalizing tank, or to the uniform discharge from the tank, the amount depending upon the process used.
3. Instead of sulphuric acid iron sulphate may be used, if that method is to be employed.
4. Milk of lime may be added in the mixing trough leading to the settling tank.
5. The settling tanks need have only 15 minutes detention for the acid-lime method or 1 hour for the iron-lime method.
6. Subsequent treatment on sand filters may be made if it is desirable to do so.
7. Alum may be substituted in the mixing trough in place of milk of lime.

The author wishes to acknowledge and give credit to Edward Martin, M. D., C. A. Emerson, Jr., and W. L. Long, who, at the time of the above work were respectively Commissioner of Health, Chief Engineer and Chief Chemist. Also to present Chief Chemist and Assistant Chemist D. P. Rogers and C. R. Lowe.

Marl for Softening Water

A bulletin issued by the Bureau of Conservation and Development announces that a market may possibly be developed for the use of green sand marl, of which there are large deposits in the southern part of New Jersey, for softening water. The bulletin states: "After certain preliminary treatment, which charges it with exchangeable sodium, the marl is placed in the water softener and the water allowed to flow through it in a manner somewhat resembling the ordinary filter. The exchangeable sodium of the treated marl combines with the calcium and magnesium, the cause of hard water, and in turn gives up a proportionate quantity of sodium to the water. To restore it to complete efficiency it is only necessary to pass a solution of brine through the apparatus.

Progress on the Wanaque Project

In driving the Great Notch Tunnel full use is made of the most up-to-date labor-saving machinery. Description continued from the May issue.

RIVER CONTROL CONDUIT

The river crosses the line of the dam at the extreme south end of the core wall, and this end has been omitted to permit the flow of the stream. Work has now been begun on the construction of a double-barrel control conduit to carry the flow of the stream during the completion of the core wall. There will be two conduits, one slightly lower than the other, it being proposed to carry the ordinary flow of the river through the lower, while the other will come into use during floods. Except when the upper is carrying flood water, it will probably be used for carrying materials from one side of the dam to the other, probably by laying a track in it and running construction trains through. Later on, it is possible that a hydro-electric power house will be located below the dam and water supplied to it through these conduits; although this point has not been finally decided, as it will depend upon the decisions made as to use of water by various municipalities.

For the time being an ingenious method has been adopted for using an ordinary derrick stationed on the north bank of the river for excavating the bench for the control conduits on the south bank at a point about 200 feet away and bringing the excavated material on to the north bank where there is room for depositing it. A derrick with a 70-foot boom carries a block on the end of the boom through which is rove a cable with one end wound on one of the drums of the engine and the other end carried across the river where it is fastened to a deadman. Suspended from a block that travels on this cable is a bucket used as dragline bucket, the cable for dragging it being wound on another drum of the engine. With the empty bucket on the derrick side of the river, by taking up slack in the main cable the north end of it is brought to an elevation of about 60 feet above the ground while the south end is only 10 feet or so, and the bucket then travels by gravity to the south side of the river, dragging its cable with it. Then, by slacking up sufficiently

on the main cable and pulling on the drag cable, the bucket acts as a dragline bucket and, by taking in or letting out on the main cable while pulling in on the drag cable, the bucket can be delivered on the north side of the river at any elevation desired, emptied into a dump car and then, by taking up the slack on the main cable, it returns to the south side again.

THE TUNNEL.

The tunnel, which is known as "Great Notch Tunnel," is to be 9,100 feet long followed by 80 feet of aqueduct in rather deep cut and another short tunnel passing under the highway, a few feet south of which is the main portal. It is possible, however, that the contractor may continue the tunnel construction the entire distance between portals, making the tunnel about 9,300 feet long. The tunnel passes under two railway tracks immediately after leaving the north portal and under another track and four highways, while the line passes comparatively close to the large Cedar Grove reservoir of the Newark water supply, to the buildings of the State Normal School and to a large cemetery. The greatest depth below the surface is slightly over 300 feet. It is not contemplated to sink any shafts, but the entire length of the tunnel will be driven from the two portals. The north tunnel is now in about 900 feet and work is beginning on the open cut leading to the south portal.

The contract also includes a northly approach of 625 feet of concrete aqueduct built in open cut and a southerly approach of 7,325 feet of aqueduct in open cut. In the former is a short section of reinforced concrete siphon by which the aqueduct is carried under two 72-inch steel pipes of the Jersey City water supply system, and in the southerly approach 675 feet is in the form of a reinforced concrete siphon under the Yantecaw river. At each end of the contract, connection chambers are to be built for connecting this work with other contracts.

In section, the tunnel will be of horseshoe shape, 7 feet high and 7 feet wide, the invert having a radius of 7 feet, the semi-circular arch a radius of 3 feet 6 inches, and the lower part of the side walls a radius of 7 feet, all inside dimensions. The aqueduct in open cut is 7 feet high and 7 feet 2⅛ inches wide. The Yantecaw siphon is circular with a radius of 3 feet 6 inches, 7 inches thick at the crown, 10 inches at the invert and 12 inches at the spring line; the reinforcement being placed 3½ inches from the inner surface and consisting of ⅜-inch square rods spaced at intervals varying with the depth of the siphon. The siphon under the 72-inch steel pipes is of practically the same construction. In the tunnel the A line of rock excavation, within which no rock must extend, is 5 inches from the inner surface of the finished tunnel, while the B line, or that to which excavation payment is made, is 14 inches from the inner surface.

About two-fifths of the length of the tunnel, at the north end, is in trap rock or true Basalt, while the southern three-fifths is in shale and sandstone.

Separate prices will be paid for the traprock and for the sandstone, respectively, the specifications classifying as sandstone anything which is not properly traprock and providing that any difference of opinion on this point between contractor and engineer shall be finally decided by the State geologist of New Jersey. The traprock can be used by the contractor for concrete and presumably will be, but the use of sandstone is prohibited.

It is expected that more or less ground water will seep into the tunnel, but it is proposed to make the concrete lining perfectly watertight. The contract accordingly provides that large inflows shall be stopped by construction of vented special concrete bulkheads in advance of the tunnel lining; by placing drains of timber or pipe under the invert where necessary, openings being left in the invert at intervals for closing the drains with concrete or grout later on; and sheet steel pans are to be installed over seeping rock and elsewhere to prevent water from injuring the concrete while it is being placed or setting, these pans being supported by nailing them to wooden plugs driven into holes drilled in the rock and calking between the edges of the pan and the rock and connecting the pan either to the invert drain or to vent pipes that will lead the water through the concrete. Small water-bearing crevices are to be calked, blind drains be used to lead water away from springs in the invert, steel pans or other suitable devices are to be installed to prevent water from dripping on to concrete while it is being placed, and, in general, such bulkheads, dams, sumps and pumping equipment are to be installed as is necessary to keep water out of the excavation while concreting.

The contractor is permitted to use either electricity, compressed air or hydraulic power in the tunnel, but not steam; and provision must be made for ventilating the tunnel. The contractor is using air for drills and for running a mucking machine and is using storage battery locomotives for hauling

Courtesy Newark Evening News.

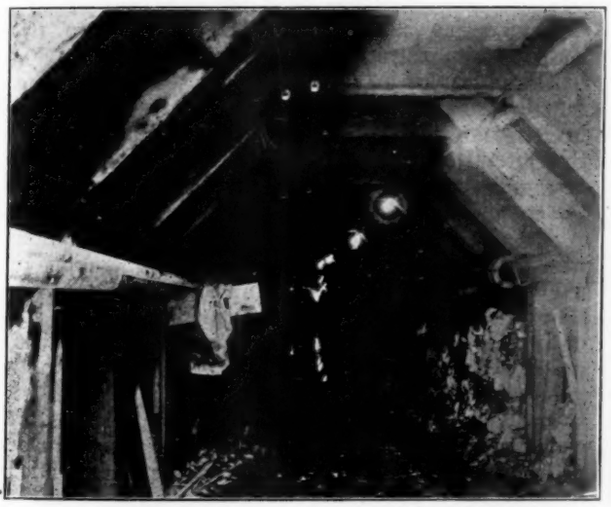
TUNNEL ENTRANCE, NORTH PORTAL.

the mucking cars. Ventilating air is provided by means of a blower.

The contractor for the tunnel is Heyman & Goodman, of Jersey City. The total of the itemized bids used as a basis of awarding the contract was $918,267.

Owing to the small size of the tunnel, only about 9 feet high and wide, the entire heading is blown at once. Twenty holes are driven in the heading, using three Water-Leyner drills. The holes are charged with six pounds of Atlas 60% powder per cubic yard and are fired in six successive shots. Drilling is performed in two shifts, and after firing at the end of each shift, the mucking is performed.

For mucking, the contractor is using a Hoar mechanical shovel, which is found to work satisfactorily in this small tunnel. It consists of a bucket arm and bucket, which is slid forward and downward until the bucket rests upon the ground at the base of the muck pile when, by pulling on the upper end of the arm, which is pivoted near the center, the bucket is crowded into the muck pile. When filled, the bucket is raised, the arm moving into a horizontal

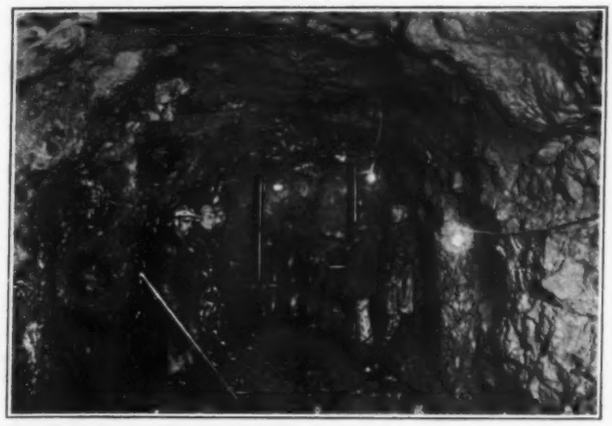


Courtesy Newark Evening News.

TUNNEL FROM NORTH PORTAL, SHOWING TIMBERING.

position, lying on top of the car. The car revolves through the entire circumference on a turntable and the bucket can, therefore, be brought over a mucking car at either the side of the shovel or in the rear thereof. The lowering, raising and crowding are performed by means of chains and short cables, compressed air being used for operating the mechanism. The operator sits in a seat alongside the car. The total height to the top of the operator's head is less than 7 feet, and the shovel can operate and revolve within a width of 7 feet or 7 feet 6 inches. One of these shovels is already in use at the north portal and another is in place for use at the south.

Owing to the narrowness of this tunnel, it is not possible to run two tracks or even a siding in the tunnel, nor to provide a switch by which mucking cars can be spotted alongside the shovel. The contractor has, therefore, provided behind the shovel a portable conveyor onto which the shovel discharges the muck, which conveyor overhangs its carriage



Courtesy Newark Evening News.

DRILLING HEADING OF TUNNEL.

sufficiently far to discharge the muck into the middle of a 3-yard, side-dump, narrow-guage car, which is spotted under it. This car is hauled by a storage battery locomotive built by the Atlas Car & Mfg. Company especially for service in a small tunnel of this kind.

At each portal the contractor has installed a plant for furnishing compressed air, electricity, etc., for the various mechanisms. Each plant is operated by a 165 h.p. semi-Diesel engine made by the Anderson Manufacturing Company, which uses ordinary fuel oil, Texaco fuel oil being used on this work. This engine drives a shaft which in turn drives by belt a large air compressor, a dynamo, a pump, and a blower, Hill clutches being used to throw the power on and off each of these. A small auxiliary engine provides compressed air for the starting tanks. The compressor is an Ingersoll-Rand "Imperial" type 10. A General Electric dynamo provides current for lighting the tunnel and the several buildings; the blower is a Connersville and provides the air for ventilating the tunnel. The pump is a small one used for circulating the water for cooling the compressor.

The oil used by the plant at the north portal is stored in a tank holding about 11,000 gallons set so as to feed the engine by gravity, while the tank itself is about 200 feet from and several feet lower than a branch of the Erie Railroad, and can readily be filled by gravity from a tank car. Air from the compressor is used by the blacksmith as well as for operating the drills, the mechanical shovel and some other equipment. The engine has been run continuously since February 1st, stopping from Saturday night to Monday morning only, except on two or three occasions when emergencies outside of the engine itself required it.

About 55 or 60 men are employed at present in the tunnel work. Most of these live in the vicinity of the work, so that it has not been necessary for the contractor to house any of the labor, although provision has been made for this.

The tunnel work has progressed at the following rates, in lineal feet of tunnel, per week: For the week ending April 14, 44 feet; April 21, 57 feet; April 28, 69 feet; May 5, 79 feet; May 12, 74 feet; May 19, 73 feet; May 26, 74 feet; June 2, 69 feet. Prior to April 7 about 450 feet had been tunneled

at rates of 16 to 67 feet a week. Most of the time, up to the first of May, an oil locomotive had been used to haul the cars, but since about May 7 the storage-battery locomotive has been used instead. The mechanical shovel was first put into operation a short time before this. The average rate of progress since April 21 involves the removal of 170 cubic yards of rock a week, or about 15 yards a shift.

On the tunnel work, Robert Parker is general superintendent for the contractor and J. A. Ward is assistant engineer on the tunnel for the Commission. At the Wanaque Dam, W. H. Gahagan is the contractor, with R. C. Young as his superintendent. Major A. H. Pratt is chief engineer for the Commission and M. R. Sherrard is consulting engineer, while N. C. Holdredge is assistant chief engineer in direct charge of construction of the entire project. The Commission consists of Lourent J. Tonnele, chairman; Wood McKee, Obadiah C. Bogardus and Thomas L. Raymond.

The Writing of Engineering Reports*

This is of importance to the engineer second only to ability to handle men. Information to be included in report, method of presenting it, and form of report.

By Nathan C. Grover, M. Am. Soc. C. E.†

Next to ability in handling men, the success of an engineer probably depends more on his skill in writing clear, concise, and comprehensive reports than on any other factor. After many years in a position which necessitates the review of numerous reports by engineers engaged in both governmental and private organizations, the writer is forced to conclude that engineering schools are giving too little consideration to this important factor in an engineer's training and are thereby overlooking one of their important duties to the engineering world.

Report writing differs as much from popular writing as does mechanical drawing from works in water colors or oils. While only a few gifted persons may become noted authors or artists, it is exceptional that an engineer can not readily train himself to make creditable mechanical drawings, and similarly to prepare meritorious reports.

In writing a report the engineer should give proper attention to a study of (1) the purpose of a report, (2) the information to be included, (3) the method of presenting the information, and (4) the form of the report.

The duties of an engineer extend beyond his study of the physical features relating to an enterprise and include questions of administration, operation, economics, and finance, and even questions pertaining to the relation of the enterprise to the community. An engineering report, therefore, may and often must discuss all these related factors on which success may depend.

Broadly, the requirements of a successful reporting engineer are:

1. To see and evaluate possibilities.
2. To formulate features of design.
3. To estimate with reasonable accuracy the cost of construction.
4. To analyze and to appraise properly the market, industrial and social conditions.
5. To prepare a clear and concise statement covering the essential features of a project.
6. To draw sound and definite conclusions.

*From "The Cornell Civil Engineer," Vol. XXXI, No. 6.
†Chief Hydraulic Engineer, U. S. Geological Survey.

PURPOSE OF A REPORT

Engineering reports may be divided into two classes—administrative and technical.

The object of an administrative report is to present information in regard to progress or status of investigations, development, or operation, in order that interested persons may be informed of its progress and that a permanent record may be made of the condition of the work at stated intervals of time.

A technical report may pertain to investigations of a project, to its development, to the operations of a going concern, or to a completed structure. Its object may be to present the important facts and conclusions pertaining to the physical or financial practicability of a project or to the economics of a going concern, for the consideration of persons interested in the construction, operation, financing, or control of the enterprise; or the report may be made primarily to record permanently the information obtained.

INFORMATION TO BE INCLUDED IN A REPORT

An administrative report should contain statements in regard to personnel, finances, progress of work, and like features, or to the factors and conditions affecting these features. If lengthy discussions of details are necessary, they should be presented in separate reports or appendixes.

Technical reports should contain statements of the technical and related features of the project or development and the conclusions derived from the statements. Every report should include—

1. An introduction stating the object of the report and giving a general description of the project or development and the sources of information.

2. A presentation, in the body of the report, of all important facts necessary to show the physical characteristics, feasibility, and estimate cost of the project, and its value when completed, as well as the elements of stability or of the risk involved, the nature of the presentation depending on the character of the enterprise. Complete statements relative to all factors affecting the project or development should be given, together with sufficient information

to indicate the reliability of the data on which the conclusions rest.

3. The conclusions should show concisely the results of the analysis of the data presented in the body of the report and the recommendations based on those conclusions. The report should be dated and signed on its final page, or a dated letter of transmittal, bearing the signature of the author, may be prepared.

Each report should include a title page, a table of contents, a list of illustrations, a list of tables, if necessary, and, if the report is long, an index. Long reports should be prefaced with an abstract of not more than two pages presenting the salient facts and conclusions. Related data or discussions not essential to a clear understanding of conditions but necessary as a basis for statements made in the report or for a detailed and critical analysis should be presented, if at all, in appendixes instead of in the body of the report.

As a basis for writing a report, an outline should be prepared and, to guard against ommissions in estimates, a drawing of this or a similar enterprise showing every possible variation should be followed.

METHODS OF PRESENTING INFORMATION

Information can be presented in three forms—text, tables, and illustrations.

All data to be used in the report should be carefully studied in order to determine which of these three forms affords the clearest and best method of presentation. Choice should be made primarily from considerations of conciseness and clearness, but the ability of the probable readers of the report to understand one or the other of these forms must also be considered.

Text.—The matter of the text should be presented in logical order and in simple and concise language. It should be divided into topics designated by center and if necessary by side headings under which the matter should be appropriately divided into paragraphs. Refereneces to information outside the report or to authorities cited should be made by footnotes. Citations of data within the report should be made by cross references, giving page numbers. Direct quotations should be exact as to wording, but errors in punctuation and other obvious printer's errors should be corrected. Proper credit for quotations, either direct or indirect, should be given in the text or in footnotes.

Tables.—Tables offer a convenient and effective method of presenting statistical data and may also be used to present facts that are common to several units or groups, in order to disclose common or special characteristics or to make desirable comparisons. For example, the industrial or other features of the cities of a State may be presented more effectively by grouping them in tables under appropriate headings than by describing them in text.

All headings for tables should be clear and concise. There may be a choice not only as to the wording of headings of columns but as to their grouping as side heads or top heads. A proper choice of these headings may make it possible to combine two tables in one, or to present a table in more condensed and convenient form. A transposition of side and top heads may improve a table both in appearance and in clearness.

Each table should have an appropriate title and in some reports the numbering of tables may increase the ease and definiteness with which references may be made to them.

Illustrations.—Illustrations may be used to amplify the text or tables or as an independent means of presenting information. In general, they may be grouped in two classes—photographs and drawings. Photographs may show either general features or details of specific features. Drawings may be used to present data graphically or plans of features of the work, or, as maps, to show the locality and the positions of important features. A number and appropriate title should appear immediately below each illustration. The title of a photograph should always include the date on which it was taken.

FORM OF A REPORT

All material in the report should be bound in regular book form. The first impression made by a report—a result of its general appearance—may determine its effect on the reader, and the ease with which it can be handled, read and studied—a result of its general arrangement and make-up—may determine to a large extent its value and usefulness.

The manuscript should be typewritten on letter paper, with liberal margins and preferably with no visible corrections either by typewriter or pen. Except for quotations and tables, which may be single spaced, the lines should be double spaced. Pages should be numbered in the upper right hand corner. Tables and illustrations should be inserted in the text at or immediately after the place of first reference to them.

Not only the title page but the first page of text should bear the title of the report and the name of its author. A blank page should precede the title page and follow the last page of the report.

So far as possible, tables and illustrations should be reduced to the size of a page. If this is impossible, the sheet should not exceed twice the height of the page, as only one horizontal fold can be conveniently handled in a bound report. The length, however, is not thus limited as the bellows system of folding permits the ready use of several vertical folds.

So far as possible all drawings should be bound in the report but large sheets that must be folded horizontally more than once may be more conveniently used if placed in a pocket portfolio accompanying the report. A careful study of scales and a proper arrangement of matter may enable the writer to present information on sheets that may be bound in the report. Under no consideration should rolls of drawings accompany a report, as they are inconvenient both for handling and filing.

Automobile Parking

As is the case in many other cities, Toledo is finding the problem of parking on the business streets a most perplexing one. In a recent statement on the subject, Traffic Captain Thomas O'Reilly says that parking on the business streets in that city, partly because of the presence of street car tracks, causes a slowing-up of all traffic, both street-car and automobile, during rush hours, to the great disadvantage of all who are endeavoring to reach their home at

that time. Removing parking from one side of these streets would greatly aid in eliminating this trouble.

Captain O'Reilly states that practically every large city in the country has rules restricting parking in the business districts. Citing a few of these, Philadelphia has no-parking districts as well as fifteen-minute, thirty-minute and sixty-minute limits. Indianapolis bans parking on certain streets. In Cincinnati certain parking stands are established but parking elsewhere in the congested district is limited to sixty minutes. Buffalo has no-parking, one-hour and unlimited parking rules. Columbus has a thirty-minute limitation in the business district. New Orleans rules have sixty-minute, fifteen-minute and no-parking restrictions; Washington, two-hours, thirty minutes and no-parking; Minneapolis, one hour; Chicago, no-parking and sixty minutes; Rochester, no-parking, thirty minutes and sixty minutes.

Salt Water Sprinkling in California

By Charles W. Geiger

The California State Board of Harbor Commissioners uses salt water for filling the street sprinklers along the Embarcadero instead of water from the city mains. For this purpose the Board has installed five centrifugal pumps at various points along the waterfront, each operated by a 5-h.p. electric motor. Pump and motor are placed in a special building at the bulkhead. The suction extends directly into the water and the discharge pipe extends under the sidewalk and is connected to a gooseneck water column used for filling the sprinkling wagons. A hose connected to the water column is inserted into the water tank and the driver of the sprinkler starts the pump in operation by means of a button just inside the pump house opposite the water column, a hand hole in the wall of the house giving access to the button and each driver being provided with a key for opening the door that closes the hand hole. The main door leading to the pump house is kept locked and only electricians employed by the Harbor Board have access to the pumps.

The pump has a 3-inch suction and a 2½-inch discharge and can fill the sprinkler tank in about three minutes. The driver stands at the pump house and, the water column being nearby, can watch the sprinkler and shut off the pump through the hand hole as soon as the tank is filled.

One advantage claimed for the use of salt water in sprinkling is that it eliminates the fly nuisance, in that it is found that flies do not breed where salt water has been sprinkled.

Refuse Salvaging at Eccles, England

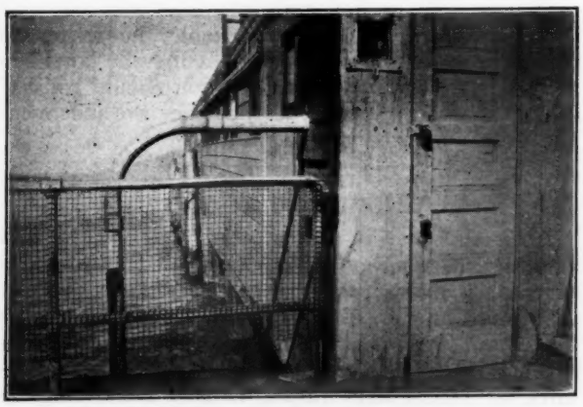
About twenty years ago the Council of Eccles, England, installed destructors for incinerating refuse and used the steam therefrom to operate machinery for pumping sewage at the disposal works. When the population increased from 36,000 to 45,000 the capacity of the plant became insufficient to destroy all the refuse or to pump all the sewage. They thereupon began developing a refuse salvaging scheme which is now in full operation.

At the salvage plant, which is located at the sewage disposal works, the contents of the vehicles are dumped on to a conveyor band which carries the material to a separating screen. The cinders, dust and small matters pass through the screen, while the paper, bricks, cans and bottles are rejected by it and deposited on a picking belt.

The fine material which passes through the screen is carried by another conveyer band to a second screen equipped with a dust jacket screen which separates the dust from the cinders. The cinders thus cleaned are taken by a conveyor belt to two boilers which are hand fed and provide the steam for the pumping plant.

The coarser materials which fall on the picking belt are picked over by hand. The cans are removed separately and baled and continue to find a ready market. Bottles, broken glass, iron scrap, etc., are all sorted and sold. Paper, for which there is no longer a market, and other combustible rubbish, are burned in the destructor furnace.

The new plant supplies, by means of the in-



PUMP HOUSE ALONG EMBARCADO.
Button for stopping and starting pump is just inside the hand hole, which is shown open.

FILLING SPRINKLER FROM WATER COLUMN.
This is across the roadway from the pump house shown in the other picture.

cinerator, all the energy necessary to drive the pumping machinery at the sewage disposal plant and, in addition, showed a net profit last year in fuel value alone of $4,500. In addition, an income was derived from the sale of tin cans, bottles and other salvaged articles. During the year approximately 11,000 tons of house hold refuse was collected, which appears not to have included the garbage.

It is reported that experiments have shown that screened cinders obtained from a given quantity of refuse produce twice the volume of steam obtained by burning the same amount of refuse unscreened, the cinders yielding an evaporation of six pounds of water per pound of cinders, while coal is reported to give an evaporation in the same plant of 8.5 pounds of water per pound of coal.

In disposing by destructor the cost of labor in handling refuse and carting away clinkers is $1.58 per ton (all costs are changed to American money on the basis of $5.00 per pound sterling); the capital charges are 37c per ton; repairs and maintenance, 25c per ton; giving a total cost of $2.20 per ton by destructor. By the salvage method the cost of dumping, screening and destroying combustible matter, including fireman's wages, is 75c per ton; repairs and maintenance, 12c per ton; capital charges on building and machinery, 21c per ton; a total of $1.09 per ton.

Comparing these apparently shows an annual saving in the handling by the salvage method of about $9,000 per year; to which should be added half the fuel value by this method over the destructor treatment, or about $8,000, or a total of about $17,000.

An analysis of the refuse treated at the plant is given as: dust, 40.58%; cinders, 37.6%; debris, 16.16%; paper, 2.9%; tin cans, etc., 1.3%; rags, sacking, etc., 0.84%; broken glass, etc., 0.62%. It is stated that the refuse dirt has a higher value in nitrogen than horse or cow manure, and it is expected that there will be no difficulty in finding sale for it at a price that will cover transportation and other costs.

Pittsburg, California, Sued for Typhoid Cases

A court decision has been rendered against the city of Pittsburg, California, in the amount of $32,821 as damages to citizens who contracted typhoid fever through the medium of its water supply. The bulletin of the California State Board of Health for March, 1923, gives the details of this case and decision.

In June and July, 1920, nearly 150 cases of typhoid fever appeared in the city and investigation apparently established the fact that a short time before raw water from the Sacramento river had been turned into the city mains, the apparatus used for treating it having been out of commission for at least a day. Nineteen persons who contracted typhoid during this outbreak combined in a suit against the city for damages incurred through illness or death, accusing the city of neglect. The result of the case was, as stated above, the awarding of damages, the largest amount to any one individual being $12,500.

In his decision the judge said: "The testimony is to the effect that the chlorinating plant was inoperative during the hours in question by reason of the fact that a drum containing chlorine gas had fixtures that did not permit of ready attachment to the city's pumping system and a special device had to be arranged in order to couple the tank to the suction system of the city's plant. The circumstances of the city's water supply being unwholesome in its raw state, being such as to carry notice of its condition, it was incumbent upon the defendant to use all reasonable precautions to render the water fit and wholesome and to give it such treatment as was necessary to produce such results."

Beccari System of Garbage Disposal

Used in several Italian cities, experimental plant in this country. Utilizes controlled fermentation to produce inodorous, humus-like material.

In the March issue of "PUBLIC WORKS" a brief description was given of the Becarri method of disposing of garbage. Since then further information and a visit to the demonstration plant installed in Paterson, New Jersey, has furnished additional data concerning this interesting innovation in garbage treatment.

The first installation of the system was in Florence, Italy, where in 1914 Dr. Becarri built two cells largely for experimental purposes, although he had previously applied the principle to farms and institutions where manure and other organic matter was transformed into a fertilizer. By November, 1922, 350 cells were in operation in Italy and 1,316 additional cells were either under construction or contracted for.

The system operates by fermentation carried on in cells known as fermentation cells which are usually constructed in groups of two or four as a unit. The functioning depends upon the action of bacteria developed in the fermenting mass. The water draining from the fermenting garbage carries with it great quantities of the bacteria which bring about the fermentation, and this drainage water is mixed with the fresh garbage as it is charged into the cell to cause a rapid development of the desired fermentation.

The cell, with a capacity of about 25 cubic yards, (or smaller where the quantities to be treated are small) has a double floor, the bottom one impervious to moisture and inclined so as to lead away the drainage from the cell, while the upper floor is formed of cement gratings upon which the garbage rests. The outside wall contains openings between the bottom and upper floors for the admission of air, which rises

through the upper floor into the garbage and also through four vertical air passages in the four corners of each cell, from which vertical passages or chimneys the air passes through openings to the under sides of horizontal fillets or baffles, three or four of which extend around the four sides of the cell. Into this cell the garbage is dumped through a trapdoor in the roof until the cell is nearly filled, when the door is closed and the garbage allowed to stand and ferment while other cells are being filled.

The gases from the fermentation pass through an opening into a small tower which connects with each unit of four cells and which contains horizontal trays on which is placed earth or substances adapted to fix the nitrogen and ammonia which constitute a large part of the gases, the liquified gases continually dripping down and finding their way into the cells to enrich the fertilizer.

The fermentation cycle usually requires from 35 to 45 days, when the material, which is now practically odorless and with comparatively little moisture, is removed through a door in one wall of the cell. This material resembles humus and is excellent for treating soils and contains considerable fertilizing property.

The capacity of one chamber being 25 cubic yards and the fermentation cycle requiring approximately forty days (including cleaning, etc., eight cycles per year are usually practicable), the number of cells necessary for any particular community can readily be calculated. As the amount of garbage to be treated increases, additional units can be added at will.

Thermometric and biological studies have disclosed a number of interesting features of the process. The temperature of the cell begins to rise on the third day after charging, the rise being more rapid nearest the bottom and sides, where air is introduced. Shortly thereafter it reaches 140 degrees to 150 degrees Fahrenheit by reason of the natural fermentation. The maximum temperature is reached on or about the tenth day after charging and remains practically constant for about twenty days, when it begins to fall and between the thirty-fifth and forty-fifth day the material has cooled sufficiently to be removed from the cell. Carcases of dead animals are reduced to skeletons entirely free from flesh in from twenty-five to thirty-five days, with at no time an odor of putrid flesh. Any material can be deposited in these cells, but of course it is uneconomical to use them for storing ashes and other inert material. On the other hand, it is hardly worth while to endeavor to remove tin cans and other materials ordinarily found in American garbage pails. If desired, these can be removed more conveniently when the resultant product is taken from the cell as a dry, comminuted mass. It is desirable however to use the cells only for the contents of garbage pails, the citizens being required to keep this matter separate from ashes and rubbish.

In designing the plant it is of course necessary to take into consideration the peak load rather than the average load. This load, however, usually comes in August and September, and as fermentation is most active during warm weather, this partially offsetting condition can be taken into account.

In order to prevent too great retarding action of cold in the winter climates of the northern part of this country, provision is made for surrounding the cells with an enclosure, from which will be drawn the air that serves to oxidize the fermenting garbage. This enclosure would also be used for temporary storage of the product removed from the cells which, because of its heat, would assist in keeping up the temperature during winter conditions.

One of the nuisances found in most garbage plants is that of flies. To prevent this, provision is made to receive the garbage carts in an enclosed area on top of the cells, which will be thoroughly screened in summer. As soon as the canvas cover is removed from a load, an insectide is sprayed over the garbage and the flies destroyed and the garbage at the same time deodorized. After having dumped its load into the cell, each garbage truck or wagon can be cleaned before leaving. This enclosure can also be used as a garage for storing collection carts during the night, the enclosure surrounding the cells being used for the same purpose if desired.

An Italian bacteriologist, Professor Guiseppi Gasperini, conducted experiments at Florence to determine the effect of Becarri fermentation on various types of micro-organisms. He found that at the end of the twenty-third day all life unfavorable to man and agriculture and all animal infesting parasites had been completely destroyed. The non-liquifying microbes of putrefaction decreased very rapidly, having practically disappeared by the tenth day, as had also the liquifying microbes. B. Coli. were found to decrease from about 375,000,000 on the first day to 100,000,000 on the thirteenth day. Anthrax sporoginies decreased from 225,000,000 to about 6,000,000 on the twenty-third day. On the other hand, certain microflora were almost eliminated during the first five days while the heat was rising, but after the forty-fifth day until the sixtieth day rose very rapidly. The part played by these species was not known but is being studied, we are informed, by Prof. Gasperini.

The general process, it is seen, is practically that which is carried on in a mulch pile which the farmer or market gardener frequently forms by the piling together of garbage, leaves and other vegetable matters and which he uses as a top dressing for vegetable gardens and the like. In the Becarri cell, however, conditions are maintained more favorable for the rapid action of bacteria, and especially for the rapid inaugurating of the fermentation, preventing of chilling during cold weather, retention and liquification of the nitrogenous gases and other features permitting of more scientific control of the function which nature itself originates in all masses of organic matter when allowed to stand undisturbed.

Operation of Gloversville Sewage Disposal Plant

Data for the year 1922 of a plant treating sewage with a high percentage of tannery wastes, using fine screens, Dortmund tanks and trickling filters.

By H. J. Hanmer *

The operation of the Gloversville, New York, sewage disposal plant may be of interest to many sanitary and city engineers because of the fact that between 35 and 40 per cent. of the sewage of the city is tannery wastes.

The following article, with its tables, will give a summary of the results of the operation of the plant for the year 1922, together with the itemized cost of the operation of the same:

Quantity and Flow—The total flow treated was 1,072.06 million gallons. The average flow passing through the treatment plant for the 12 months was 2.94 m. g. d.

Screen Chamber—The total screenings removed from the bar screens were 3,482 cubic feet, or 3.4 cubic feet per million gallons of sewage treated.

Grit—The deposits of sand and grit in the primary tank inlet troughs were removed 6 times during the year. The total amount was 1,115 cubic feet or 1.04 cubic feet per million gallons of sewage treated.

Fine Screens—As the sewage effluent leaves the primary tanks it passes through fine-mesh wire screens ranging in size from ½ inch down to ⅛ inch mesh. No record was kept of amount of deposit on these screens as they were cleaned by being removed and washed with a hose, this being a continuous operation from 7 a. m. until 8 p. m. from Monday until Friday, inclusive, and on Saturdays and Sundays from 8 a. m. until 5 p. m.

Primary Tanks—The primary tanks are two in number, of the Dortmund type, about 48 feet deep and 35 feet in diameter, with hopper-shaped bottoms. Sludge was drawn from the tanks about four days each week, the average time of drawing being about 1½ hours daily on those days on which drawing occurred.

During the twelve months, 6,365,450 gallons, or about 5,935 gallons of sludge per million gallons of sewage treated, was pumped to the sludge drying beds.

Averages of monthly averages of the analyses of the primary tank sludge indicate a solid content of 4.44 per cent. and a specific gravity of 1.015.

Using these averages, the amount of dry solids removed in the form of primary tank sludge was about 1,930 pounds per million gallons of sewage treated.

Distributor Manholes—There are three of these manholes on the main distributor, one at each secondary distributor leading to each acre of trickling filters. A large amount of grease collects in these manholes, and during the year about 512 cubic feet of grease and sludge were removed from them.

Trickling Filters—The filters, which have an area of 3 acres, have been operated so that each of the three units was rested in alternation for two weeks at a time. Of the 620 nozzles in operation at one time, an average of about 50 per day have been cleaned. It is necessary to clean the nozzles once every year, due to the incrustation on the underside of the lobes of the spindles.

Secondary Tanks—The secondary tanks are two in number, of the Dortmund type, about 29 feet deep and 35 feet in diameter and with hopper-shaped bottoms. Sludge was drawn from these tanks from once to five times per month, depending upon the unloading of the trickling filters.

During the year 2,194,600 gallons of sludge, or about 2,050 gallons per million gallons of sewage treated, was drawn and pumped on to the sludge beds.

Averages of monthly averages of analyses of the sludge gave a solid contents as 6.02 per cent. and a specific gravity of 1.016. With these averages the amount of dry solids removed in the form of secondary tank sludge was 1,030 pounds per million gallons of sewage treated.

Sludge Beds—The area of the four sludge drying beds is about 2.65 acres. All four beds were

Summary of Results of Analyses of Crude Sewage, Jan.-Dec., 1922.

Parts per Million. (Straight average of bi-weekly composite samples.)

Total Solids	Organic Solids	Suspended Solids	
		Total	Organic
1662	512	416	280

Organic Nitrogen	Albuminoid Nitrogen	Ammonia Nitrogen	Oxygen Consumed
38.09	13.73	16.57	272.7

HAULING DRIED SLUDGE FROM DRYING BED.

*City Engineer of Gloversville, N. Y.

EFFICIENCY OF DISPOSAL PLANT AS SHOWN BY ANALYSES

Average results for the year 1922.

Primary Tanks

	Influent	Effluent	Removed	% Removed
Settling solids, c.c. per liter in 2 hrs., quiescent sedimentation	10.00	1.49	8.51	85.1
Total suspended solids, p.p.m.	416	134	282	68
Organic suspended solids	280	97	183	65
Total organic nitrogen	38.09	29.33	8.76	23
Suspended organic nitrogen	16.02	7.90	8.12	51
Total albuminoid nitrogen	13.73	9.70	4.03	29
Suspended albuminoid nitrogen	6.82	2.70	4.12	60
Total oxygen consumed	272.7	151.8	120.9	44
Suspended oxygen consumed	62.3	20.9	41.4	67

Trickling Filter

	Influent	Effluent	Removed	% Removed
Total suspended solids	134	139	Increase	
Organic suspended solids	97	113	Increase	
Total organic nitrogen	29.33	19.99	9.34	32
Suspended organic nitrogen	7.90	7.04	0.86	11
Total albuminoid nitrogen	9.70	7.52	2.18	23
Suspended albuminoid nitrogen	2.70	3.20	Increase	
Free ammonia nitrogen	14.63	12.45	2.18	15
Total oxygen consumed	151.8	124.3	27.5	18
Suspended oxygen consumed	20.9	20.3	0.6	2.9

	Nitrites	Nitrates
Nitrogen in effluent, p.p.m.	0.98	1.38

Secondary Tanks

	Influent	Effluent	Removed	% Removed
Total suspended solids	139	64	75	54
Organic suspended solids	113	51	62	55
Solids settling in 2 hours, c.c. per litre	2.03	0.32	1.71	86
Total organic nitrogen	19.99	17.53	2.46	13
Suspended organic nitrogen	7.04	3.75	3.29	47
Total albuminoid nitrogen	7.52	5.02	2.50	33
Suspended albuminoid nitrogen	3.20	1.56	1.54	48
Ammonia nitrogen, p.p.m.	12.45	12.26	0.19	2.0
Total oxygen consumed	124.3	113.5	10.8	9
Suspended oxygen consumed	20.3	13.6	6.7	34

	Influent	Effluent	p.p.m. Difference
Nitrite nitrogen	0.98	1.38	—0.40
Nitrate nitrogen	1.38	1.19	—0.19

Efficiency of Entire Treatment Plant (not including sand beds) as shown by analyses.

	Influent	Effluent	Removed	% Removed
Total suspended solids	416	64	352	85
Volatile suspended solids	280	51	229	82
Total organic nitrogen	38.09	17.53	20.56	54
Suspended organic nitrogen	16.02	3.75	12.27	76
Total albuminoid nitrogen	13.73	5.02	8.71	64
Suspended albuminoid nitrogen	6.82	1.56	5.26	76
Ammonia nitrogen	16.57	12.26	4.31	26
Total oxygen consumed	272.7	113.5	159.2	58
Suspended oxygen consumed	62.3	13.6	48.7	78

in operation during the year and received approximately 1,130,357 cubic feet or 8,364,640 gallons of wet sludge, both primary and secondary. About 5,555 cubic yards of dry sludge was hauled from the beds by the city team and 122 cubic yards by the farmers, making the total removed 5,677 cubic yards. The depth of wet sludge, if applied proportionately to the 2.65 acres of beds, would have been 9 2/5 feet.

Gloversville's sewage disposal plant was operated under the immediate supervision of H. J. Hanmer, city engineer, with Saul Robinson, chemist, in charge.

ITEMIZED COST OF OPERATION

Foreman	$1,560.00
Chemist	1,617.00
Office building and tool repair	23.14
Miscellaneous labor	167.60
Telephone	57.37
Electric power for pump	270.98
Gas and electricity	123.18
Team account	752.37
Materials and supplies	347.99
Sand for sludge beds	72.43
Removing and replacing cover to trickling filters	230.34
Operation and maintenance of screens	2,219.26
Operation and maintenance of centrifugal pump	1,300.68
Operation and maintenance of trickling filters	571.61
Operation and maintenance of sludge beds	2,706.10
Operation and maintenance of sand filters	198.41
Operation and maintenance of land	192.56
Cutting grass and brush	47.17
Maintenance of roads and lawns	201.55
Cleaning troughs in tanks	48.45
Total	$12,708.19

Winter Destruction of Boston Streets

In a communication to the Commissioner of Public Works, Mayor Curley of Boston stated that last winter was unquestionably the most severe that the city has known in its history, with a total snowfall of 70 inches and with ice coating the streets for a period of nearly ten weeks. He recommended that spring cleaning and repairing of streets be begun before the end of March instead of waiting until April or May as is customary.

More than two-thirds of the street mileage of Boston, or approximately 420 miles, is of macadam or Telford construction and is always in need of repair at the close of even a mild winter, but a great many of them are now, the Mayor states, in actual need of complete reconstruction because of the severity of the past winter.

Hard Winter on Roads

Reports are received from all sections in the eastern states of unusual destruction of roads by heaving. For instance, State Highway Commissioner Greene of New York State reported in April that he would need about $3,000,000 to put in shape the roads that had boiled up in that state this spring. the damage being much greater than ever before. It was attributed by him to the unusually large amount of heavy trucking done during the winter. He declared in some cases the roads have boiled as high as 5 feet for areas of from 10 to 70 square feet. It seems very probable that one of the principal causes contributing to the excessive heaving of roads during the past winter was the unusual extent to which the departments have kept the snow cleared from the roads, the snow in former years having served to protect the road and its subgrade from the low temperature.

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A. PRESCOTT FOLWELL, Editor

CONTENTS

Co-operation for Public Officials

A feature of the discussions at the convention of the American Water Works Association last month that impressed the writer was the frequent and general advocacy of co-operation between public officials and private citizens in securing the observation of laws and regulations rather than resort to threats of penalties and punishment.

In considering the best methods of protecting water-sheds, for example, the several speakers on the subject were almost unanimous in their belief that continuous protection from pollution and freedom from objectionable uses were almost impossible of attainment by patroling and efforts to enforce regulations by arrests and legal actions; but that appeals to the owners of property, and education of them and of the citizens at large on the dangers to water consumers of the practices objected to, would result in 75 to 90 per cent. of the citizens acting as voluntary inspectors to restrain the 10 to 25 per cent. of refractory ones.

Again, engineers and health officials who are searching for methods of preventing the pollution of streams by trade wastes reported finding manufacturers not only willing to adopt proved methods of treating the waste waters from their plants, but even offering to co-operate in investigations aimed at the development of such methods.

Managers of privately owned public utilities also told of securing the good-will of the citizens they serve by showing their own good-will toward the municipality. An impersonal corporation, bent only on making money for its stockholders, is naturally an object of suspicion and dislike to the average citizen; but let the personal representative of the corporation take a public-spirited interest in municipal affairs as a fellow citizen with the other business men, and display the same intent to please its customers, and this animosity will disappear.

As is frequently stated, the public generally wishes to be reasonable and fair, and if public officials will themselves be so, will take the trouble to prove the reasonableness of the regulations they promulgate (and admit it if they find it unprovable), and will ask the co-operation of the citizens in carrying them out, many of their present difficulties and dissentions will disappear.

Unfair to the Contractors

More than two months ago a southern city received bids for an 80-ton garbage incinerator. The contract was awarded and the contractor gave a bond, but for six weeks following the award the city council continued unable to agree upon a location for the incinerator and the commissioner of health finally recommended that the company be relieved of the contract and its bond returned. For the time being, however, action was deferred in the hope that a location might shortly be settled upon.

Most contracts contain provisions that the contractor must begin work within a certain number of days after being awarded the contract and notified to begin, and that he will be subjected to penalty for delay. Few if any, however, contain any clauses providing for awarding satisfaction to the contractor if he himself shall be delayed. Here we have the construction held up for two or three months and possibly more after the awarding of the contract for no fault of the contractor but for one which lies entirely with the city. Meantime the contractor is carrying a bond, presumably is holding men and material in readiness to start the work, and probably is liable to loss through increase in cost of materials and labor. He undoubtedly will have some recourse to law should the city attempt to cancel the contract, but can he obtain reimbursement for these losses if the contract is carried out?

This is not the only instance, by any means, of

long delays in beginning the work for which the party of the first part is entirely responsible. In the majority of cases the contractor is not only wasting time which means money to him, but is suffering an actual loss through delay. It seems to us that an equitable form of contract would contain proper provision for protecting the contractor, as well as the city or other party of the first part, against loss from delays caused by the other party to the contract.

The Escanaba Manager Plan

Escanaba, Mich., is the first city to establish a city manager corps, according to the "National Municipal Review," its new charter providing for a group of managers. The new government is starting with a manager and two assistant managers.

Says Robert T. Crane in the Review: "A number of cities have provided for an assistant manager in the sense of a deputy or vice-manager. The Escanaba plan is different. By the charter, the manager is head of all departments until otherwise provided, as is the case in many municipalities. But when it is necessary to relieve the manager of some portion of his task, other cities have set up one or more department heads in addition to the manager. These new department heads in such cities mark a notable change from the prior situation; the headships of the department are henceforth divorced from the manager's office. Escanaba, on the contrary, keeps the headship of every department where it started—in the manager's office. It does so by assigning the direct management of a department, when necessary to relieve the manager, to an assistant manager, and as many assistant managers may be employed as the council shall determine."

Mr. Crane believes that this plan will tend to cause the selection for city manager of men with executive ability as their great qualification rather than engineering ability. Also, that it will help to provide trained managers in that these may be selected from the most promising of the assistant managers.

Baltimore Division of Permits

The Division of Inspection, Permits and Footways of Baltimore in 1922 earned $17,859 over and above the salaries of all per-diem inspectors, clerks and assistants on monthly salaries, and the chief inspector. "This estimate includes amounts which accrue from billing public service corporations, individuals and contractors for the use of city inspectors on permits which we issue and includes cash deposits made with the city comptroller on the permits issued for the storage of building material in the public streets and other inspections of a miscellaneous character." The charges for permits during the year totalled $35,044.

Among the items covered by these permits was the construction of 13,795 feet of conduit by the Chesapeake & Potomac Telephone Company, which called for approximately 2,000 square yards of repaving by the Street Repair Division. The city is now collecting from this company in duct rental the sum of $63,589. Six thousand nine hundred different locations were inspected for work done by the United Railways and Electric Company in renewing and repairing tracks and structures. This company repaved within its track area 18,828 square yards of sheet asphalt pavement and approximately 25,000 square yards of other improved pavements, all of which was inspected by this division. For the gas company, inspection was given on 100,000 feet of gas mains and 360,000 feet of service pipes, as well as work repairing leaks, etc. In addition to inspecting 12,000 openings made in the public streets by this company, the division made 2,000 preliminary inspections before issuing permits.

The various pole and electric operating companies performed work under 5,280 permits in 12,000 different locations.

Rudolph Hering

Rudolph Hering died in New York City on May 30th.

Dr. Hering was 76 years old and for 35 years had been the outstanding figure in sanitary engineering in the United States. In 1886 he reported on the water supply of Philadelphia. He was largely responsible for the adoption of the plans for the construction of the Chicago drainage canal for removing the sewage of that city; he was a member of the commission which in 1904 recommended that New York obtain its water from the Catskill Mountains, and had been employed as consulting engineer at some time by most of the large cities of the country on either sewerage or water works problems. He was largely responsible for the prominence of the Imhoff tank in sewage treatment in the United States.

He was for several years a member of the firm of Hering and Fuller and later of the firm of Hering and Gregory. His last work of prominence was the writing of a book on Collection and Disposal of Municipal Refuse, in collaboration with Samuel A. Greeley. He retired from practice two or three years ago and returned from an extended European trip last October.

He was a very prominent member of the American Public Health Association, American Society of Civil Engineers, American Society for Municipal Improvements, and other technical societies. For a generation he was the acknowledged dean of sanitary engineering in this country. In spite of his years he was up to the last exceedingly active both physically and mentally and maintained a deep interest in all matters relating to sewerage, water supply and refuse disposal and was a frequent attendant at the conventions of all societies interested in those subjects. The convention of the American Water Works Association in Detroit a week before his death was, we believe, the first he had missed in some years. At this convention the directors had recommended to the society that he be elected to honorary membership, which recommendation was unanimously adopted by the convention.

American Waterworks Association Convention

Papers, discussions and other features of interest at the forty-third and most successful convention of this society, held in Detroit, May 21st to 25th.

The forty-third annual convention of the American Waterworks Association at Detroit was attended by a larger number of members, it is believed, than any previous convention of this society. On the morning of Friday the secretary reported 528 active members as having registered and about 200 associate members, while the number of guests was nearly 400, although only about 200 of them were from out of town. There was no question, after the first day, that the required number of railroad certificates would be presented for securing the half-fare return rate, and, in fact, nearly 600 of these certificates were received by the secretary.

The meetings were unusually well attended, not less than 100 to 150 being present at every session and a considerably larger number at some of them. The exhibits were similar in character to those seen at most of the conventions of this society in recent years and even greater in number. They occupied two large rooms adjacent to the assembly hall.

During the last two days the members met in two different halls as two sections, the superintendents and the chemists and bacteriologists.

Practically no discussion was given to the papers read on Tuesday and on Wednesday, but with the papers on Thursday morning discussion began which continued throughout the remainder of the convention, it being necessary in some cases to cut short the discussion of a paper in order to complete the program. Thursday's papers comprised reports of the various committees of the Standardization Council, while Friday's sessions consisted of sectional meetings by the superintendents in one room and the chemists and bacteriologists in another.

The convention devoted an unusually large proportion of its time to meetings and discussions and only one half day to any entertainment feature. The superintendents even began on Monday afternoon a discussion of the topics and questions on the superintendents' program, while other members listened to and discussed a description of the methods of accounts and records kept by the Detroit Waterworks. Business sessions were held three times on Tuesday and Thursday and twice on Wednesday and Friday, each session being about 2½ hours long. This was probably as long, considering the number of meetings, as could be profitably attended by the delegates without overtiring them, although it seems to us unfortunate that more serious effort was not made to begin the sessions promptly at the time appointed, each of them being about 30 minutes late in starting.

The next convention is to be held at Memphis. The officers for the year 1923-24 will be: George W. Fuller, president; Frank C. Jordan, vice-president; William W. Brush, treasurer, with presumably no changes in the secretary and editor.

The Executive Committee proposed and the convention elected as honorary members: George H. Benzenberg, Desmond Fitzgerald, Rudolph Hering, William Mulholland, Sir Alexander Houston and J. H. Purdy.

The reports of the finances by the secretary, the treasurer and the finance committee showed the society to be in a healthy condition in this respect. The expenditures had been kept within the budget and were several hundred dollars less than the income. The finance committee recommended a budget for the coming year of $23,000, which allowed some increases in the expenses of the Secretary's office, for publishing proceedings, and a few other items.

The Nicholas S. Hill, Jr., Cup for the section showing the largest percentage of growth was awarded to the North Carolina section which showed a 66-2/3 per cent. increase.

NARRATIVE OF THE CONVENTION

By Monday night about 300 active members and 140 associate members had registered, and, although the formal sessions did not begin until Tuesday, a very interesting and well-attended, informal meeting was held at the office of the Detroit Waterworks, where was described by certain officials of the plant the method of keeping accounts and making records and reports, and the subject was discussed by those present. At the same time a meeting was held at the Hotel Statler by the superintendents, at which the first ten or twelve subjects on the list of questions that had been prepared for discussion were taken up.

TUESDAY

Tuesday morning's session began with the president's annual address. The publication committee and finance committee asked to have the presentation of their reports postponed to a later session.

The standardization council referred to its report which had already been published in the May issue of the Journal of the society. The council urged that the reports of its committees be discussed, both at the meeting and later by correspondence if members were not prepared for discussion at the convention, these discussions to be published in the Journal later. Mr. Fuller,

chairman of the council, stated that it was its policy to change one or two members of each committee each year so as to insure a continuity of policy.

The report of the committee on standard form of contract also had already been published in the Journal and the chairman, J. Waldo Smith, referred to this published report.

Following this, Mortimer P. Lane, of the Department of Commerce, representing Secretary Hoover, read a paper which consisted of a survey of the present business situation. He asked that the members of the society make general use of the regular publications of the department giving the latest information on current business conditions and, by following the recommendations contained therein, aid in stabilizing the business of the country.

Sheriff Walters of Wayne County gave an address of welcome in place of the Mayor, who was absent from the city on business, in which he was seconded by Col. Francis L. Sward, the water commissioner.

A paper on "The Use of Constant and Variable Speed Motors for Driving Water and Sewage Pumps," illustrated with lantern slides, was read by F. L. Adams. This was followed by a paper by Charles B. Burdick of Alvord, Burdick & Howson, describing a number of pumping stations that had been built by them as engineers and explaining some of the general principles employed by them in designing. Special attention was paid to the new 21st Street pumping station at Des Moines, while stations at Orlando, Gary and other cities were referred to and photographs of them shown upon the screen. In general, the important features were considered to be the use of incombustible material for the roofs, provision in the design for expansion or duplication of machinery necessary for a number of years to come, and attention to lighting, ventilation and general neatness of appearance in the station and grounds and architectural treatment of the building.

"Determining the Proper Equipment for Pumping Stations" was the title of a paper by Arthur L. Mullergren, in which he dealt with the pumps, boilers and auxiliary equipment. The author's opinion that turbine-driven centrifugals had reached the point of development where they were the most economical pumping equipment was questioned by J. N. Chester, who did not believe that such a pump was economical for capacities below 15,000,000 gallons per day with coal at $4 a ton or more, but he believed that for such sizes the horizontal cross compound was still a more economical pump.

In the afternoon C. C. Cocert read a paper, illustrated with lantern slides, entitled, "Records of Stream Flow, Their Use and Best Methods of Obtaining Them for Municipal and Industrial Purposes." In this he described the methods employed by the U. S. Government engineers, telling how to select gauging stations, the different methods of gauging suitable for various widths and depths of stream, different types of gauges employed, etc. Scotland G. Highland called attention to the importance of "The Collection and Daily Publication of Meteorological Data by the Water Department." Dabney H. Maury described some recent large waterworks projects with which he had been connected, including those at Denver, Norfolk and Tulsa, also the construction of waterworks for the Army cantonments. At the conclusion of this paper Mr. Maury referred to the suits brought against a number of the men connected with the construction of the cantonments and expressed with feeling the injustice being done them, and following this paper the society unanimously adopted a motion that the Attorney General be requested to bring these cases to immediate trial; this being in line with similar motions which had been adopted by a number of other organizations of engineers and contractors during the past few months.

The last paper of the afternoon was a description by James W. Armstrong, with lantern slides, of the design of the proposed water filtration plant at Baltimore. This plant contains several unusual features, one of the most important being the entire omission of strainers in the filters, the floors being made simply in the form of planes draining to an outlet, on which are placed directly gravel and sand in sizes graded from coarse to fine. One of the filters of standard construction in the existing Baltimore plant had been altered a year or more ago by removing the strainer system and placing the filtering material directly upon the floor and had been operated in this way in the general service of the station for a year without giving any trouble whatever or showing any indications of a penetration of the sand into the supporting gravel. There were also a number of other features in which the proposed filter plant will vary from the standard practice.

The evening session was devoted to two papers; one descriptive of the waterworks of Detroit, by George H. Fenkell, and the other a description of the Detroit filtration plant, approaching completion, by Theodore A. Leisen, both abundantly illustrated with lantern slides. These gave the delegates a good idea of the waterworks of the city which they were to visit the following afternoon. The papers had been printed in advance and were distributed to those present, and the authors confined themselves largely to a running comment on the pictures shown upon the screen.

WEDNESDAY'S SESSIONS

The morning session opened with the paper of James R. McClintock describing, "Recent Water Developments at Memphis." Mr. McClintock's firm had reported upon a reconstruction of the Memphis waterworks in order to secure additional water to meet the growing demands and also one that would give less trouble from iron and other impurities. The use of the river water was not considered the best solution, but it was finally decided to drill new wells within convenient drawing distance of the pumping station and treat the water for the removal of iron and of carbon dioxide by aeration and rapid filtration. Caleb M. Saville then described "The Hartford Method of Paying for Waterworks Construction," referring especially to extensions of the distribution system. This paper was not discussed at this meeting, but on the following day, at the meeting of the waterworks superintendents, there was considerable discussion and comparison of methods employed in different cities. The final paper of this session was one entitled, "Municipal Team Work," by Frank C. Jordan. Mr. Jordan gave the word "neighborliness" as embodying the spirit that he believed should actuate the superintendents of waterworks in their dealings with consumers and other city departments.

Following the papers, the special order of business of selecting the place for holding the 1924 convention was taken up. Among the cities which the committee reported as having sent invitations were: Atlanta, Chicago, Des Moines, Evansville, Los Angeles, Memphis, Milwaukee and Montreal. At the first ballot Memphis and Montreal were almost tied, with the others receiving very few votes, and a second ballot between these two resulted in the choice of Memphis.

In the afternoon the guests left by buses, furnished by the Waterworks Manufacturers Association, for the Detroit filter plant, where a luncheon was served, followed by a trip by boat through Lake St. Clair.

The evening session consisted of three papers by members of the Manufacturers' Association, in which James H. Caldwell described the manufacture of a 28-inch gate valve by the Ludlow Valve Manufacturing Company; John D. Capron showed in moving pictures the manufacture of cast-iron pipe, first by the old method and then by the centrifugal method; and D. R. Johnson, by moving pictures, described the method of installing a brass well screen and then recovering such a screen from a well. At 9:30 the members adjourned, most of them to a smoker given by the Waterworks Manufacturers Association.

The nominating committee reported the following choice of the committee for elective offices next year: President, Frank C. Jordan; vice-president, Harry F. Huy and Chas. B. Burdick; treasurer, W. W. Brush; trustees, District 3, E. M. Hoopes; District 6, F. M. Randlett and J. A. Jensen.

THURSDAY'S SESSIONS

Thursday was devoted to reports of the standardization council committees; being preceded, however, by the postponed paper of Beekman C. Little entitled, "Iodine Treatment of a Water Supply as a Preventative of Goitre," in which Mr. Little advocated administering to consumers at intervals of about six months minute doses of iodine.

The reports of the Standardization Council committees had been printed and some had been already published in the *Journal*. For this reason they were presented in more or less brief abstracts.

Water Shed Protection—The first of these was the report of the committee on Watershed Protection, presented by H. E. Moses. The committee did not advocate the ownership of watersheds, believing that such ownership would not protect against trespass and would probably give over-confidence on the part of water users if not of the water department, and believed that even the purchase of marginal strips in inhabited watersheds is of doubtful value in reducing the pollution. Several members discussed this report.

Allen Hazen advocated ownership to prevent or control the manner of development of the shed if for no other reason, even though it were not considered practicable or desirable to remove the present occupants or to prevent further development, and in this he was endorsed by Mr. Little. Mr. Chester raised the question of the legal status of an investment in an extensive watershed when the question of rate-making came before the public service commissions.

H. F. Ferguson, chief engineer of the Illinois State Department of Health, referred to the tendency of cottagers to build along the shores of lakes and large reservoirs unless prevented by control of the watershed. The State Board considers that all surface supplies require treatment and that it is impracticable to entirely prevent pollution. It considers that bathing is largely a matter of sentiment and for this reason confines it to some distance from the waterworks intake, establishing zones, each zone having its own restrictions which become less stringent as the distance from the waterworks intake increases. Mr. Saville believed in stringent rules even though they were not enforced, believing that they would have a moral effect, and that there would be less fishing, bathing, etc., if it was known that doing so was illegal.

George R. Taylor believed marginal ownership of reservoirs to be very desirable in order to prevent cottages along the shore and fishing. He had found the best policy to be a co-operation with the residents on the watershed in the prevention of pollution of the reservoir, this consisting in some cases of assuming the disposal of sludge from septic tanks and privies and the removal of other wastes in such way as to prevent pollution of the water. In his opinion, the milk inspectors working in the district should co-operate with the waterworks company or department. His company also took an interest in the health of the residents on the watershed and endeavored to co-operate with them in maintaining sanitary conditions. One advantage of co-operation was that it is generally almost impossible to obtain convictions if cases of violation of laws for protection of watersheds are taken before a jury.

Herman Rosentreter, of Newark, stated that the ownership of the watershed from which that city derived its supply had resulted in a very considerable reduction in the bacterial content of the water. Another member stated that in New York regulations concerning watersheds were enforced jointly by the State Board of Health, the local Board of Health and the water board or company. If, following the complaint of the last named or for other reasons, the state board called upon the local board to enforce the regulations and it refused to do so, the state board can mandamus the local board.

Industrial Wastes Pollution—The report of the Committee on Industrial Wastes in Relation to Water Supply was presented by Almon L. Fales in abstract and discussed at some length. In this, even more than in the previous discussion, co-operation was recommended by the members. Mr. Bartow had found co-operation with manufacturers successful in restricting beet sugar pollution and that from other sources. Beet sugar pollution exists for only 70 to 120 days per year and it is therefore impracticable to construct elaborate plants for treating this waste. In general, he believed that the most promising solution of this problem lay in the conservation of wastes.

Mr. Chester referred to the enormous amount of drainage from the coal mines that reached the streams of Pennsylvania. The right of the mines to discharge these acid waters into the streams is the subject of a suit which has already been through one court and will probably be carried to the supreme court for decision. Two very stringent bills were before the Pennsylvania Legislature (which was still in session during the convention) and Mr. Moses explained in detail the present status of these bills, only one of which had any prospect whatever of passing. Mr. Bohman referred to the tastes in the Milwaukee water which were at first attributed to chlorine but which were later found to be due to wastes from the manufacture of tar products. Mr. Saville stated that the Connecticut Legislature had passed a bill looking to the abolishing of wastes by preventing the installation of new plants contributing such wastes, then by requiring the elimination of those for which there are known remedies, with the hope of discovering remedies for the others and applying them later on.

Richard Messer, state engineer of the Virginia Health Department, through a representative, reported that legislation in that state has not yet become necessary but that the manufacturers show a readiness to co-operate with the state department in minimizing stream pollution. L. L. Jenne, of the Philadelphia Bureau of Water, stated that nature had co-operated with the city in purifying the water in the Schuykill river in that, after receiving the acid mine wastes, it flowed through a limestone country where the lime neutralized the acids. By co-operation with the gas plants along the river the city had secured a very considerable reduction in the tarry discharges. No method, however, had been found for preventing the tastes due to tar compound wastes. Very great improvement in taste could be obtained by the slow sand type of filter, whereas the rapid sand produced apparently no effect.

McKeesport's experience with the treatment of acid waters was reported by E. C. Trax. Robert Spurr Weston considered the problem was an economic one and that the economics of the problem should be given first consideration. He stated that in his state also manufacturers were eager to co-operate, one having even voluntarily asked the state board of health to advise and aid it in preventing stream pollution.

C. M. Baker stated that in Wisconsin the problem was mostly one of stream pollution rather than of water supply. The manufacturers were reasonable, but industrial pollution cannot be entirely prevented. The state suggests or offers co-operation rather than endeavoring to enforce stringent regulations. Mr. Baker recommended that a committee of waterworks men, manufacturers, conservationists and others co-operate in efforts to find solutions to the problem. Mr. Ferguson stated that the Bureau of Mines is beginning an investigation to determine whether it is possible to cure the nuisance due to coke oven wastes, this action being the result of a recent meeting of several federal departments interested in the subject.

At this point Dow R. Gwinn introduced a motion that the third Tuesday in May be celebrated as "Waterworks Day," the citizens being invited to visit the waterworks plants. This was adopted after the mover had accepted the amendment that the date be set by the executive committee.

Cast Iron Pipe—The report of the committee on Standard Specifications for Cast Iron Pipe was presented by Frank A. Barbour. The committee had paid special attention to the test bar and had studied a special type, and recommended that the deflection increase with the breaking load. It seemed to have been demonstrated that some at least of the manufacturers of cast iron pipe had been turning out a poorer product during the past few years than formerly and, in fact, that the prod-

uct of less than 75 per cent. of the manufacturers would meet the proposed specifications. The committee also is investigating the matter of testing a ring cut from the end of the pipe rather than a bar, the ring more truly representing the iron as it is actually furnished consumer.

Thomas H. Wiggin thought it probable that the deterioration was due to the poorer coke furnished to the pipe manufacturers by the coke companies and to the overworking of the cupolas during recent years. He did not consider the bar a good test of cast iron, since molten iron cast into a bar does not crystallize in the same way that it does in a pipe or other large casting and the testing of rings seemed to him to be preferable. Messrs. Hawley and Saville believed that foundry practice is as important in the manufacture of pipe as the chemical or physical characteristics of the metal used.

Meter Schedule Slides—The report of the committee on Steps Towards Standardizing Stated Quantities for Slides in Meter Schedules was presented by Isaac Walker in the absence of the chairman, Allen Hazen. The committee reported that it presented a report based upon the New England Waterworks schedule adopted about six years ago. Cities using this schedule had all been questioned and reported themselves pleased with it, and individual members of the New England Waterworks Committee had no important changes to recommend. This committee had only one change to recommend, and that was the addition of a fourth special rate for large industries. Reference was made to the serious objection raised in many states to the service charge and the term employed by Daytona, Florida, "annual maintenance charge" was suggested as probably being less objectionable to some of these non-technical critics. J. N. Chester approved of the schedule but believed that there would be some cases when only two sets would be desirable and others where more than four should be employed. He called attention to the fact that the state of Ohio forbids service charges in any form or name and that a similar law almost passed the present Pennsylvania Legislature.

The two committees considering "Essential Data for Water Records and Reports," Committee A for municipal plants and Committee B for privately-owned plants, had already printed their reports and these were accepted as progress reports, but certain inconsistencies between them were pointed out and the committees were instructed to get together during the coming year on the principles involved.

J. H. Gregory introduced a motion that the City Council of San Francisco be requested to rescind its action in naming the Hetch Hetchy dam the "O'Shaughnessy Dam," in that that name had already been given to a dam at Columbus, Ohio, in honor of Jerry O'Shaughnessy and that having two "O'Shaughnessy" dams would be a subject of much confusion. After some discussion the convention voted in opposition to the motion.

(To be continued)

Flushing Snow in Springfield

The chief engineer of the Water Department of Springfield, Massachusetts, Elbert E. Lockridge, in his report for 1922 stated that the use of water for flushing snow from the streets constitutes the greatest menace to efficient water service and at times entirely deprives the city of fire protection, presumably by using practically the capacity of the mains. He stated in this report that the practice was still being continued, but with the opening of a new bridge, the possibility of dumping some of the snow into the river through openings provided would, he hoped, reduce the amount of flushing and that still other means would be found of disposing of more of the snow in some manner other than wasting the water and reducing the pressure to the consumers and incurring considerable risk in case of fire.

In connection with sprinkling streets, Springfield has taken precautions against damaging fire hydrants, which might well be copied by other cities. There are in the city 85 crane hydrants or standpipes used for filling sprinkling carts, 51 owned by the waterworks department and 34 by the street department. In addition, the street department has 29 track hydrants for car sprinklers and 57 special hydrants installed for street washing. This is a total of 171 special hydrants installed for the sprinkling and washing of streets. With this generous provision there should be no excuse for the use of the regular fire hydrants for any purpose other than fire protection, and presumably there is no damage done to the hydrants by such use, as so commonly occurs in other cities.

Oiling Pennsylvania Roads

The State Highway Department of Pennsylvania employs a regular schedule, decided upon in advance, for oiling roads and publishes this schedule for the information of the traveling public. It endeavored to cover as many of the principal highways as early in the spring as possible, 120 separate road sections having been given surface treatment in one week of May. Only one side of the road was oiled at a time.

The maintenance division of the State Highway Department was discontinued May 15th and the maintenance work is now being carried on through four divisional headquarters, the employees formerly connected with the maintenance division being divided among these four divisions. The engineers in charge of the new divisions are: J. S. Ritchey, for the Northeast Division; Samuel P. Longstreet, for the Southeast Division; Thomas C. Frame for the Northwest Division and S. W. Jackson for the Southwest Division. William A. VanDuzen, formerly assistant maintenance engineer, will have charge of the direction of automotive transport and will direct the highway transport survey.

Paying for Repaving

Percentage of cost of original pavement and of repaving assessed against abutting property by several hundred cities.

In the issue of February of this year we published several tables of paving data and referred to a table on "Payment for Repavement," which was omitted from that issue for lack of room and is given on the three following pages. This information was furnished by the city engineers or other officials of the cities in question. The reason for the question answered in the third column is that some cities do not assess "repaving" against abutting property, but do not consider macadam or a less durable surface as "paving" and therefore assess when paving replaces such a surface.

PAYMENT FOR REPAVEMENT

City	Percentage abutting property pays on: Original pavement	Percentage abutting property pays on: Re-paving	Are sand-clay, gravel or macadam classed as pavement?
Alabama:			
Birmingham	100	100	Yes
Arkansas:			
Blytheville	100	None	No
Searcy	100	100	Yes
California:			
El Centro	100	100	No
Oakland	100	100	Macadam
Santa Ana	100	None	No
Santa Barbara	80-100	90-100	....
Santa Monica	100	None	No
Santa Rosa	100	100	Yes
So. Pasadena	100	100	Macadam
Upland	100	50	Macadam
Vallejo	100	None	No
Visalia	100	None done	....
Whittier	100	100	No
Colorado:			
Denver	100I	None	No
Fort Collins	all but 50% of intersections	Same	Yes
Longmont	100	No rule	No
Pueblo	100	None	....
Connecticut:			
Ansonia	None	None	....
Bridgeport	None	None	....
Bristol	33⅓	None	No
Greenwich	50	None	No
Hartford	50	None	No
New Britain	$1.50 per front foot	....	No
New Haven	(m)	....	No
New London	None	None	No
Putnam	None	None	....
Wallingford	None	None	No
Willimantic	None	None	....
Delaware:			
Wilmington	66⅔	....	No
District of Columbia			
Washington	50p	50p	Macadam
Florida:			
Key West	25	25	No
Tallahassee	33⅓	None	No
Georgia:			
Americus	100	None	No
La Grange	66⅔	66⅔	....
Macon	66⅔	66⅔	No
Idaho:			
Boise	100I	100	No
Pocatello	100	100	No
Twin Falls City	100	....	No
Illinois:			
Benton	100	....	....
Canton	75	75	No
Carterville	100	....	Yes
Centralia	100	100	None used
Champaign	100	100	....
Chicago	100	100	No
Chicago Heights	100	100	No
Clinton	90	None	....
Collinsville	100	None done	Yes
Danville	85-90	50-90	No
Decatur	100	100	No
Dekalb	80	90	No
Duquoin	100	....	No
East Moline	100	100	No
East St. Louis	100	100	No
Edwardsville	95	90	....
Galva	100	....	....
Joliet	95	95	No
La Grange	100	100	Yes
Macomb	None	12-20	....
Mattoon	90-95	90-95	None used
Moline	....	75	No
Monmouth	100	100	No
Naperville	85-90	....	....
Normal	90	90	No
Oak Park	100	100	Macadam
Ottawa	95	95	No
Quincy	75	75	No
Riverside	100	100	....
Robinson	100	None yet	No
Rockford	70-85	None	....
Waukegan	Nearly all	Nearly all	No
Winnetka	100I	80	....
Indiana:			
Anderson	100	100	Yes
Attica	100	....	Yes
Boonville	100	....	No
Elwood	100	100	Yes
Fort Wayne	83-90	83-90	No
Frankfort	100I	100-I	No
Gary	100I	100-I	Yes
Huntington	....	....	Yes
Jasonville	100	....	Yes
La Porte	100I	100-I	....
Logansport	100I	....	Yes
Indiana (Continued)			
Martinsville	100	None	No
Peru	100I	100-I	No
Seymour	100	100	Yes
South Bend	100	100	Yes
Terre Haute	100	100	Yes
Wabash	100I	None	No
West Lafayette	100I	100-I	Yes
Winchester	100	100	....
Iowa:			
Albia	100	....	Not used
Boone	65	65	....
Cedar Rapids	100	100	....
Chariton	100	None	....
Charles City	100	....	Have none
Clinton	60	60	No
Creston	100	100	No
Davenport	100	100	Not used
Decorah	100	100	Gravel
Eagle Grove	100	100	No
Fort Dodge	100	100	Gra'l & ma.
Keokuk	100	100	Macadam
Muscatine	100	None	Gravel
Ottumwa	100	100 in best section, 10 to 50 in p.	None used
Sioux City	100	100	....
Spencer	100	None done	No
Waterloo	100a	100	No
Kansas:			
Atchison	100	100	No
Chanute	100	100	No
Columbus	100I	....	No
Fort Scott	100	100	....
Independence	100	100	Yes
Junction City	100I	....	Yes
Kansas City	100I	100-I	Yes
Leavenworth	100	....	Yes
McPherson	50	50	Yes
Paola	100I	....	Not used
Parsons	100	100	Macadam
Salina	100	100	No
Topeka	100I	66⅔	Yes
Wichita	100I	100-I	Yes
Kentucky:			
Ashland	100	None	No
Bowling Green	100	None	No
Corbin	100	None	Yes
Lexington	100	100	Yes
Paducah	None	None	No
Richmond	33⅓	33⅓	No
Maine:			
Augusta	None	None	....
Bangor	None	None	....
Gardiner	None	None	....
Lewiston	None	None	....
Portland	None	None	Yes
Rockland	None	None	No
Maryland:			
Hagerstown	33⅓	None	Sometimes
Massachusetts:			
Attleboro	None	None	....
Brockton	None	None	....
Easthampton	None	None	....
Fitchburg	None	None	....
Greenfield	None	None	No
Haverhill	None	None	....
Hudson	None	None	....
Lexington	None	None	....
New Bedford	None	None	....
North Adams	50	None	No
Peabody	None	None	Yes
Pittsfield	50	None	Only bit.ma.
Rockland	None	None	....
Somerville	50 r	None	....
Waltham	50	None	Only bit.ma.
Webster	None	None	....
Worcester	Stone blk. & con., n'n; T. ma. 66⅔	None	No
Michigan:			
Ann Arbor	80	None	No
Bay City	70	70	No
Benton Harbor	100	100	No
Cadillac	100-I	....	Macadam
Detroit	100	None	No
Dowagiac	100-I	....	No
Flint	100-I	100-I	Yes
Grand Rapids	100	....	Yes
Hastings	70	None	No
Holland	100-I	None	No
Iron Mountain	None	None	....
Ironwood	None	None	....
Kalamazoo	100	100	No
Lansing	60	60-30	Yes
Midland	67	None	No
Mt. Clemens	100	None	No
Muskegon	100	100	No
Muskegon Heights	75	....	No

PAYMENT FOR REPAVEMENT

(Continued)

City	Percentage abutting property pays on: Original pavement	Percentage abutting property pays on: Repaving	Are sand-clay, gravel or macadam classed as pavement?
Michigan (Continued)			
Negaunee	None	None	No
Niles	100-I	....	No
Owosso	60	40	No
Pontiac	83	None	No
Port Huron	100	all minus first cost	Yes
Saginaw	100-I	Same	Yes
Sault Ste. Marie	66⅔	....	....
Sturgis	100-I	....	No
Three Rivers	100	....	No
Minnesota:			
Albert Lea	100	100	No
Austin	100-I	....	No
Brainerd	100-I	66⅔	....
Crosby	100-I	None	No
Duluth	100-I	100-I	Yes
Ely	50	None	Yes
Fairmont	100	None	No
Faribault	100	None yet	No
Little Falls	75	None	No
Minneapolis	25-33⅓	25-33⅓	No
Montevidio	100-I	None	No
Owatonna	100-I	100-I	Yes
Rochester	100	100	No
So. St. Paul	25	None	No
Staples	100-I	100-I	No
Stillwater	100	....	No
Winona	100-I	100-I	Macadam
Missouri:			
Boonville	100	100	....
Brookfield	100	100	None used
Cape Girardeau	100	100	Yes
Carthage	66⅔-75	....	No
Clinton	100	100	....
Excelsior Springs	100	100	Yes
Fulton	100	100	No
Hannibal	100	100	....
Joplin	100	100	Yes
Kansas City	100	100	No
Kirksville	100	100	....
Maplewood	100	100	No
Marshall	100	100	Macadam
Monett	100	100	Yes
Poplar Bluff	100	100	No
St. Joseph	100-b	100	Macadam
St. Louis	100	100	....
Sedalia	100	100	No
Springfield	100	....	None
Montana:			
Anaconda	100	None	No
Billings	100	100	Yes
Bozeman	100	100	No
Butte	100	100	None used
Glendive	100-I	None	No
Great Falls	100	100	Yes
Helena	100	100	Yes
Kalispell	100	100	No
Lewistown	75-100	None	No
Livingston	100	....	None used
Nebraska:			
Columbus	100-I	....	No
Fremont	100-I	....	No
Grand Island	100	100	No
Hastings	100	100	No
Lincoln	100	100	No
Norfolk	100	100	Yes
North Platte	100	None	No
Omaha	100-I	100-I	....
Scottsbluff	100	....	No
New Hampshire:			
Berlin	None	None	....
Laconia	None	None	No
Nashua	None	None	No
Portsmouth	None	None	No
New Jersey:			
Bergenfield	100-I	None	Yes
Bridgeton	75	100	....
Camden	85-c	60-c	Not used
Cape May	None	None	....
Clifton	66-80	....	None used
East Orange	100	50 c	Yes
Edgewater	None	None	No
Freehold	20	None	No
Irvington	100-I	....	No
Jersey City	100	none	No
Long Branch	66⅔	None	No
Newark	95c	70-20 h	Yes
New Brunswick	100	None	None used
Newton	None	....	None
Passaic	60c	None	....
Phillipsburg	None	None	....
Plainfield	100	....	Macadam
Ridgefield Park	80-70 o	None	No
Roselle Park	50 c	....	....
Rutherford	None	None	Macadam
New Jersey (Continued)			
Salem	None	None	No
So. Orange	66⅔	66⅔	No
Summit	None d	None d	Macadam
Trenton	10-50	None	No
Wallington	66⅔	....	....
West New York	65-75	None	None
West Orange	100	....	No
New Mexico:			
Albuquerque	100	None	No
Roswell	100	None	No
Santa Fe	100	....	....
New York:			
Amsterdam	50	50	No
Auburn	50	None	No
Binghamton	50	50	No
Buffalo	100	33⅓	No
Carthage	None	None	....
Cohoes	50	....	No
Corning	66⅔	66⅔	No
Cortland	66⅔	40	Macadam
Elmira	40	40	No
Endicott	50	....	No
Fulton	33⅓	None	No
Geneva	66⅔	66⅔	No
Glens Falls	50	None	Macadam
Gloversville	75	35	No
Gouverneur	None	None	Yes
Herkimer	66⅔	66⅔	No
Ithaca	16⅔	16⅔	No e
Jamestown	100	....	No
Johnson City	50	None	....
Johnstown	33⅓	33⅓	Macadam
Kingston	None	None	....
Lackawanna	50	None	Macadam
Lancaster	50	50	No
Little Falls	50	50	No
Lockport	66⅔	66⅔	Yes
Lynbrook	None	....	No
Massena	None	....	No
Newburgh	33⅓	None	No
N. Y.-Manhattan	100	None	No
Niagara Falls	100	None	....
No. Tonawanda	100	None	No
Ogdensburg	33⅓	33⅓	No
Olean	100	None	No
Oneida	66⅔	66⅔	No
Oneonta	66⅔	66⅔	Macadam
Port Chester	50	25	Yes
Poughkeepsie	33⅓	33⅓	Macadam
Rochester	100	100	Macadam
Schenectady	100	None	No
Syracuse	100	None	No
Watertown	50	50	No
Waverly	66⅔	....	No
North Carolina:			
Asheville	33⅓	16⅔	....
Charlotte	100	None done	Macadam
Durham	33⅓	None	No
Greensboro	100	None	No
Mount Airy	25	None	Yes
Oxford	50	....	....
North Dakota:			
Fargo	100	100	None used
Grand Forks	80	80	None used
Mandan	100 m	....	No
Minot	80	....	No
Wahpeton	100	100	No
Ohio:			
Akron	98	50	Macadam
Alliance	98	50	Macadam
Ashtabula	98-1	50-I	Yes
Bellaire	98	50	....
Bellevue	98	....	No
Bucyrus	98	50	Macadam
Cambridge	98	50	....
Chillicothe	98	50	No
Cincinnati	98	50	Macadam
Columbus	98	50	None used
Conneaut	98	....	....
Dayton	98	98	Yes
Delaware	98	50	Yes
Elyria	33⅓-I	50-I	No
Findlay	98	50	No
Granville	98	50	Yes
Greenville	98	50	No
Hillsboro	None	None	No
Ironton	98-I	50-I	....
Lakewood	98	50 or 33-f	....
Lancaster	90	50	No
Lorain	85-I	50	Macadam
Marion	98	50	No
Middletown	98	None done	....
Newark	98	50	No
Niles	98-I	50	Macadam
Oberlin	98	50	Yes
Ravenna	98	50	No
Salem	98	50	Yes
Struthers	98	98	Macadam
Tiffin	98-I	....	No
Troy	50	None done	No

PAYMENT FOR REPAVEMENT

(Continued)

City	Percentage abutting property pays on: Original pavement	Percentage abutting property pays on: Re-paving	Are sand-clay, gravel or macadam classed as pavement?
Ohio (Continued)			
Warren	98	50	Macadam
Washington C. H.	98	....	Yes
Wooster	98	....	No
Zanesville	98	50	Yes
Oklahoma:			
Chickasha	100	....	None
Enid	100	100	None
Muskogee	100	80-I	Some cases
Norman	100	80	No
Sapulpa	100	....	....
Shawnee	100	80	Have none
Tulsa	100	....	No
Wagoner	100	None	....
Oregon:			
Ashland	100-I	....	....
Astoria	60-b	100	Yes
Corvallis	100	100	In parts
Dallas	100	100	Yes
Marshfield	100	100	None
Oregon City	100	100	Yes
Portland	100	100	Macadam
Salem	100	....	No
Pennsylvania:			
Allentown	100-I	None	....
Altoona	100	None	No
Bangor	33⅓	None	No
Berwick	66⅔	None	No
Blairsvillle	33⅓	....	Yes
Bradford	100-I	None	No
Butler	66⅔	None	No
Catasauqua	None	None	....
Chambersburg	33⅓	None	No
Clairton	100-I	None	No
College Hill	33⅓	None	No
Connellsville	100-I	None	No
Dale	None	None	....
Duquesne	100	None	No
Easton	No rule	None	No
Ellwood City	66⅔	None	No
Emporium	66⅔	....	No
Farrell	66⅔	None	No
Freeland	33⅓	33⅓	No
Greensburg	66⅔	None	No
Greenville	66⅔	....	No
Grove City	100-I	None	No
Hanover	66⅔	None	No
Harrisburg	100-I	None	No
Hazleton	66⅔	None	No
Huntington	33⅓	None	No
Indiana	66⅔	None	....
Jersey Shore	66⅔	66⅔	Macadam
Lebanon	100-I	None	No
Meadville	100-I	None	Macadam
Monongahela	66⅔	None	No
Munhall	66⅔	None	No
Nazareth	66⅔	None	Macadam
New Brighton	33⅓	None	No
New Castle	70	None	Macadam
North East	66⅔	None	No
Northampton	None	None	No
Oil City	100	None	No
Parkesburg	None	None	....
Perkasie	None	None	No
Pittston	33⅓	None	No
Pottsville	None	None	Macadam
Rankin	66⅔	None	No
Reading	None	None	No
Reynoldsville	66⅔	....	No
Ridgeway	33⅓	33⅓	No
Royersford	33⅓	None	No
Sayre	66⅔	50	No
Scranton	90	50	No
Sewickley	66⅔	None	No
Sharon	100-I	None	No
Sharpsville	None	None	....
Somerset	33⅓	....	No
Throop	66⅔	None	No
Tyrone	66⅔	....	No
Williamsport	100-I	None	No
Woodlawn	66⅔	None	None used
York	100-I	None	....
Rhode Island:			
Cranston	None	None	....
Pawtucket	None	None	....
Providence	None	None	....
Woonsocket	None	None	....
South Carolina:			
Charleston	100	g	No
Chester	50	None	No
Florence	66⅔	....	No
Greenville	50	None	No
Orangeburg	66⅔	None	No
South Dakota:			
Deadwood	None	None	No
Madison	100	....	No
Sioux Falls	100	None done	No
Tennessee:			
Clarksville	33⅓	None	....
Cleveland	⅔ of pav. proper I	None	Yes
Dyersburg	66⅔	....	No
Murfreesboro	66⅔	....	No
Trenton	None	None	....
Texas:			
Amarillo	66⅔	None	No
Ballinger	66⅔	....	No
Beaumont	55	....	No
Bonham	33⅓	....	Yes
Cleburne	100-I	Some	No
Corpus Christi	75-I	....	....
Denton	66⅔	66⅔	Mac. & Gra.
Eastland	33⅓	....	No
Mexia	75	None	....
Mineral Wells	100	None	Yes
Navasota	33⅓	....	Yes
Paris	33⅓-I	33⅓	No
San Angelo	10	None	No
Tyler	66⅔	None	No
Weatherford	33⅓	None	No
Utah:			
Brigham	100	None	No
Logan	100-I	....	....
Provo	100	100	No
Salt Lake	80	80	No
Vermont:			
Barre	50	None	Macadam
Bennington	None	None	....
Rutland	None	None	No
Virginia:			
Danville	None	None	No
Washington:			
Aberdeen	100	....	Yes
Dayton	100	100	Yes
Mount Vernon	100	100	No
Olympia	100	....	....
Puyallup	100	None	No
Raymond	100	....	....
Seattle	95	100	Macadam
Walla Walla	100	None	....
Yakima	100	....	....
West Virginia:			
Bluefield	100-I	100-I	Yes
Charleston	100	50	No
Clarksburg	100-I	100-I	....
Fairmont	66⅔	None	No
Morgantown	100	100-t	....
Wisconsin:			
Beloit	100-I	100-I-u	Yes
Delavan	100	....	....
Green Bay	100-I	....	....
Janesville	100-k	100-k	Macadam
Kaukauna	100-I	None	No
Lacrosse	100	50	....
Lake Geneva	100-I	....	No
Manitowoc	50	50	No
Marinette	65	None	Yes
Menominee	57.7	None	No
Merrill	66⅔	66⅔	Yes
New London	66⅔	None	No
Norwalk	50	None	Macadam
Ripon	33⅓	None	No
Sheboygan	66⅔	u	Yes
Stevens Point	100-I	100-I	No
Tomahawk	100	....	No
Waukesha	100	....	No
Wausau	50	....	....
Wisconsin Rapids	66⅔	66⅔	No
Wyoming:			
Casper	100	None	Yes
Sheridan	100	100	No

a—Except where valuation is too low to admit of full assessment. b—Assessment zone extends ½ the distance to the next parallel street. c—Approximate. d—If ordered by common council, abutting property assessed according to benefits received; otherwise city pays whole cost. e—Unless some other type of pavement is laid over old macadam. f—50% if pavement is more than 20 years old; 33% if less. g—None during 20 years, all after 20 years. h—70% on residential streets, about 20% on thoroughfares. I—Exclusive of intersections. k—Up to $3 per sq. yd. l—Except sub-grading. m—Side assessed back 150 ft.; first 50 ft. 70%, next 50 ft. 20%, next 10%. n—Flat rate per front foot, $1.00 for wood blk., 75c. for concrete, 60c. for asphalt on concrete base and 50c. on old macadam base, and 40c. for bituminous macadam. o—80% amesite, 70% concrete. p—Up to a width of 40 ft. r—Tar macadam only. s—If built under the Special Improvement District plan. t—After 15 years. u—Up to $3 a sq. yd.

Paving Across Indiana Marshes

During 1922 the state of Indiana, assisted by federal aid, built a considerable part of a highway from Gary, Indiana, to the Michigan state line over what is known as the "Dunes Highway," the total length of which will be about 25 miles. Near the west end of the job the road crosses a long marsh and then cuts across alternate sand ridges and marshes. In these swampy areas there is a layer of peat on top of the fine dune sand.

The first two or three miles of the pavement is constructed on a fill about 5 feet deep placed directly on the peat bog. To secure material for this fill a ditch was excavated along the side of the embankment with an Osgood convertible shovel and dragline. The peat or muck removed from the top was used to build up shoulders of the embankment and the sand removed from below was placed upon the roadway. Part of the fill was sufficiently far from the ditch to make it safe, in the opinion of the engineers, to lay the pavement at once, but the western 4,500 feet of the embankment was left unpaved through the winter to permit any uneven settlement to take place before paving. In this section test pits were dug through the fill to the original ground at a number of points at which levels had been taken in cross sectioning, and a small opening to the old surface was left lined with boards so that future settlement could be determined by levelling. In addition, soundings in the ditch will be made, to learn whether the subsoil is being pushed sideways by the weight of the embankment. Last winter the contractor on this section, The General Construction Company of Gary, Indiana, carried on some heavy grading so that concreting can be started early in the Spring.

In laying pavement on the fills across the marshes, bar reinforcement weighing 56 lbs. per 100 square feet is used, but elsewhere a plain 1-2-3 concrete slab is specified. The highway is made 20 feet wide throughout, 7 inches thick at the sides and 8 inches at the center. No expansion joints are used. Five ⅝-inch round rods are used at each construction joint as dowels to keep the joints even, these bars being wrapped to prevent bonding with the concrete.

The concrete is finished with Lakewood finishing machines. The fresh concrete surface is tested with an 8-foot straightedge and any inequalities remedied at once.

Water supply was obtained by driving to a depth of 10 to 15 feet five sand points, each consisting of a pointed cylindrical screen 2½ inches in diameter, connected to a pump by 1½-inch pipe. All material had to be distributed by industrial railway as there was no existing road for part of the distance and the fine sandy soil made trucking out of the question.

Sand for New Hampshire Highway Construction

The state of New Hampshire has made a study of its native road-building material more thorough and scientific probably than any other state in the Union, this study having been begun in 1917. It is now practically completed although presumably an investigation of special materials or uses of materials will be continued by the state highway geologist, who has been making these studies.

Stone, gravel and sand are about the only road building materials in the state, except silt and clay that may be used for asphalt pavements. There is very little rock in the state that furnishes a first-class road building material. Gravel, however, is very common and there is considerable sand. Of the samples of the various materials submitted and tested by the state testing engineer, 80% of the rock samples were found unsuitable and 70% of the sand samples, while only 11% of the gravel samples were unsuitable.

A general survey of New Hampshire sands was begun in 1921 and considerably extended in 1922, in accordance with a co-operative agreement between the state highway department and the U. S. Bureau of Public Roads. During the past year the greater part of the field work was given to the study of sand deposits and collections of sand samples for testing by the state laboratory. New Hampshire sands are considered to be more variable in mineral composition and in other physical characteristics than those of most states and are especially rich in feldspar. The general presence of feldspar perhaps explains the very large number of failures in tests of tensile strength of concrete made by the state laboratory.

The mineral composition of the sands is studied under the microscope and compared as to percentages of quartz, feldspar, mica, slate chips, etc., and the strength of concrete made with the various samples is compared with these analyzes. One fact of practical importance that has been learned from the tests is that sands rich in slate splinters show almost without exception a high tensile strength. The state highway geologist reports that "this is surprising, inasmuch as slate chips are both soft and cleavable; and must be due to the effect of needle-like or lath shape splinters of slate becoming interlaced in the mix and so reinforcing the concrete. Practical concrete workers have been inclined to reject such sands as these on the ground that they are 'dirty,' that is, dark colored, and not 'sharp.' Without our laboratory tests, therefore, we would have been in danger of condemning slaty sands, which are among the best we have."

Transportation Survey in Connecticut

The Bureau of Public Roads and the Connecticut State Highway Department in September of last year began making a survey of transportation conditions in that state which is the most complete of its kind ever undertaken, it is believed. There are two branches of the traffic survey, one an intensive survey taken at eight key points throughout the state, the other an extensive survey taken at fifty-six stations. Observations were made at each intensive station for an entire week every two months, and these observations will be continued for a period of a year, obtaining records of seasonal variations of traffic. The observations at the fifty-six selected

stations are made for one day in each month. The fifty-six stations are divided into eight districts, one surrounding each of the eight intensive stations.

The observations made at the intensive stations relate to truck traffic only. Every truck passing the stations during the period of observations is stopped, weighed and measured and the make and capacity of vehicle, the commodity it carries and its origin and destination are determined, frequency of its trips and whether it is engaged in a public trucking business or is operated privately.

At the extensive stations both passenger and truck data are obtained, these including the number and make of each car, number of passengers, capacity and cargo of trucks, origin and destination, number of trips made by trucks each week and time required per trip, and whether the passenger cars are operated for business or pleasure.

The results of the survey for the entire year will, of course, not be available for several months yet, but information collected during the first few months gives the following results:

During the three months from September 11th to December 2nd, approximately one-quarter of the total motor truck net tonnage was transported over the highways for a distance of 9 miles or less, one-half of it from 10 to 69 miles and one-quarter of it 70 miles or more. Of the passenger vehicle movement, 35% was for business purposes and 65% for recreation. When used for business the number of passengers per vehicle averaged 1.7, and 3 when used for recreation. The average business mileage was 29.7 and the recreational mileage 55.5.

Comparing the seasons, in January and February the motor truck traffic showed 40% decrease below that for October and the passenger vehicle traffic a 68% decrease. Weights of the loads of 10,465 trucks between September 11th and December 2nd showed 29.6% overloaded beyond their rated capacity. There was apparent a tendency to increase the percentage of overloaded truck bodies as the width of load increases.

Per Capita Consumption of Cement

An interesting statement of the per capita consumption of cement in each of the states of the Union, together with figures for total consumption, has been made public by the Portland Cement Association. The figures supplied show that during 1922 there were shipped into the several states 115,263,000 barrels of cement. The maximum number going to any one state was 13,212,000 to New York, with 10,343,000 to Pennsylvania and 9,649,000 to Illinois. The minimum quantity was 91,000 barrels to Nevada and the next smallest 229,000 to Wyoming.

The average amount per capita to the entire United States was 1.06 barrels. The maximum per capita was 2.19 barrels to California and the next was 1.76 to Arizona, followed by 1.69 to Wisconsin and 1.60 to Delaware. The smallest per capita was .23 to Mississippi and the next smallest .28 to Arkansas.

The per capita consumption in 1922 far exceeded that of any other year, the figures for 1920 and 1921 being 0.87 each year, the figure for 1919 being 0.77 and the figure for 1918 0.65.

Municipal Testing Laboratories

Essential duties and value of a material testing laboratory to a city.

The "Rochester Engineer," the monthly publication of the Rochester Engineering Society, contains in its February issue the prize competition essay of the Society for 1922 written by H. L. Howe, Jr., entitled "The Value of a Material Testing Laboratory to a Municipality." The essay certainly makes a strong claim for such a laboratory, some of the most important items of which are briefly abstracted below:

"The essential duties of a municipal testing laboratory may be briefly outlined as follows:

"1. To develop or adopt uniform standards and specifications. 2. To establish a fair and scientific basis for the purchase of materials and supplies. 3. To check the qualities of the materials purchased. 4. To advise as to the proper usage of materials and control manufacturing processes. 5. To reduce the risk costs to both the contractor and the city. 6. To aid in the advancement of the knowledge of materials."

Concerning standard specifications, he recommends the adoption of those which are widely accepted rather than others, no matter how meritorius, that are prepared by employees of a given municipality, since the former most fully eliminate a great deal of undesirable controversy and result in greater efficiency in expenditure of public funds, while less objection can be offered to their provisions than if they were employed by one or two cities only.

"By furnishing contractors with information as to the character of materials from various sources, the laboratory can to a large extent reduce the risk cost to both the contractor and the city and to a large extent prevent the delivery of inferior materials to the site of the work." It also performs a service to the honest contractor by making it difficult for unscrupulous contractors to underbid their competitors. Standardized specifications for materials for municipal work will often be copied by local industries, thus benefiting them and tending toward a standardizing of the materials purchasable in the local market.

"Besides the routine testing of such construction materials as cement, concrete aggregates, asphalt cement and pavement aggregates, building and paving brick, asphalt block, tile, etc., the laboratory should investigate and inspect local sources of materials such as sand and gravel pits, stone quarries, brick and tile yards, and particularly the asphalt pavement mixing plants."

The laboratory should serve not only the engineering department, but also the city's school, building, fire, police, water, purchasing and other bureaus, shops, garages and utilities. For example, it should determine the value of the city's fuel, gasoline, grease solvents, garbage grease and tankage, soap, fire hose and boots, lubricants, paper, paints and other products that can be bought on almost absolute merit.

Recent Legal Decisions

CITY'S REPAYMENT OF DEPOSIT AGAINST FORFEITURE OF FRANCHISE HELD VALID

A municipality conferred a franchise upon a depot and terminal company, authorizing it to occupy the city's streets and property for the construction of a union depot and terminals, the construction to begin within one year from a fixed time. The franchise provided for a deposit by the company, which would become the property of the city if at any time the franchise was forfeited. Differences arising between the parties, relating to the existence of the city's right to forfeit for noncompliance with the terms of the grant, the city council later revoked the franchise, and in the revoking ordinance authorized the return of the deposit to the company. The Ohio Supreme Court, Cincinnati Union Depot etc., Co. v. City of Cincinnati, 137 N. E. 14, holds that under these facts the return of the deposit was not a gift by the city, and its repayment was within the power of the city council.

CONSTRUCTION OF WATER FRANCHISE ACQUIRED BY ANOTHER MUNICIPALITY

The Pennsylvania Supreme Court holds, City of Bethlehem v. City of Allentown, 118 Atl. 643, that the construction for several years of a water company's franchise as giving the company the right to supply a municipality with water cannot be questioned, except by the commonwealth, even where another municipality has acquired the franchise. The court suggests the desirability of legislation permitting municipalities so situated to move for condemnation and valuation of the property involved, including the franchise value.

MUNICIPAL CORPORATIONS NOT LIABLE IN DAMAGES FOR FAILURE TO LIGHT STREETS

The Minnesota Supreme Court holds, Bojko v. City of Minneapolis, 191 N. W. 399, that the authority conferred upon the city to light its streets and other public places is governmental in character, is permissive, not made an absolute duty, and a negligent performance thereof, or a failure to perform at all, does not render the municipality liable in damages. The nonliability of the municipality in such cases is the prevailing rule in this country. The city is therefore not liable for an injury caused by such failure.

MUNICIPAL CORPORATIONS NOT REQUIRED TO LIGHT STREETS OR BRIDGES

The laws of Iowa do not require cities and towns to light their streets. The Iowa Supreme Court therefore holds, Shannon v. City of Council Bluffs, 190 N. W. 951, that it is not negligence to fail to do so unless the condition of the street is such that reasonable care on the part of the city would require that it be lighted.

TOWNSHIP AND ITS OFFICERS NOT LIABLE FOR INJURIES FROM DEFECTS IN HIGHWAY

The Nebraska Supreme Court holds, Pester v. Holmes, 191 N. W. 709, that a township organized under the township organization act in that state is not liable to persons injured by defects in the public highways within the limits of such township. Its duty is to keep the highway in repair, a governmental duty for the negligent performance of which it is in no way responsible to private individuals. This exemption of the township from liability extends to its officers, agents and servants in the prosecution of work upon the highway.

NEBRASKA—PUBLIC ROAD ACQUIRED BY TEN YEARS' USE

The Nebraska Supreme Court holds, Lee v. Everly, 191 N. W. 699, that where a public road has been attempted to be established by proceedings under the statute and opened and traveled by the public for more than ten years, the public thereby acquires an easement therein, and the court will not examine the original proceedings for the laying out of the road and determine whether or not they are valid.

SALE BY CITY OF VACATED STREETS BELOW ACTUAL VALUE

The Nebraska Supreme Court holds, Karlin v. Franciscan Sisterhood (City of Columbus, Intervener), 192 N. W. 122, that when the charter of a city of the second glass gives authority to the mayor and city council to sell vacated streets, a sale of such vacated streets by the city should not be set aside merely because the selling price may not equal the actual value, unless such selling price is so grossly inadequate as to cause a presumption that there was fraud, or that the mayor and council had not acted in good faith.

CITY'S REMEDY AGAINST THIRD PARTY IN DEFAULT FOR DAMAGES TO INJURED PERSONS

The North Dakota Supreme Court holds, Keller v. City of Fargo, 192 N. W. 313, that a municipal corporation required to pay damages to a person injured on its streets (in this case by falling over frozen dirt piled on each side of the sidewalk by an independent contractor after filling in an excavation), unless the corporation is also a wrong-doer, has a remedy over against the third person who is at fault.

POWER TO REQUIRE PERMITS FOR OPERATION OF QUARRIES IN MUNICIPALITIES

In an action to restrain the enforcement of an ordinance of the city of Minneapolis requiring a permit for the operation of stone quarries, the Minnesota Supreme Court holds, Meyers v. City of Minneapolis, 191 N. W. 609, that under the general welfare clause of the charter of Minneapolis its common council may require a permit for the operation of a stone quarry within its limits. The owner of such a quarry must have a permit before operating, and without applying for it he cannot have an injunction against the enforcement of the ordinance requiring it. The ordinance is held valid on its face. If the quarry owner is wrongfully denied a permit, he has a remedy. The power of regulation resting in the city is extensive, but must be exercised within constitutional limits.